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CONTENTS

EDITORIAL:

Wide Stock Distribution 161
Electro-Gas Signals 161
Action of Nebraska Employees..... 161
Self-Cleaning Front Ends..... 162
Case-Hardening Locomotive Bearings... 162
Locomotive Ratios. 163
Design of Roller-Bearing Center Plates. 164
New Publications 164

ILLUSTRATED:

Method of Applying Flexible Staybolts to Locomotive Boilers 169
Locomotives for Heavy Service on the Norfolk & Western..... 170
Roller-Bearing Center Plates 171
Steel-Underframe Stock Car Draft Gear 172
The Plant of the Milwaukee Car Mfg. Co 174
Denmead Ten-Wheel Freight Engine.... 176
Early Brake Tests in England..... 178
Union Station at Winnipeg, Man..... 180
Cost of Locomotive Repairs; A.,T. & S.F. 182
Locomotives of Eastern Ry. of France.. 185

LETTERS TO THE EDITOR:

For Safe and Economic Car Wheels.... 165
Chilled Cast-Iron Wheels..... 167

MISCELLANEOUS:

Combustion Processes in English Locomotive Fireboxes 173
Work of the Rail Committee of the Maintenance of Way Association. 175
Self-Cleaning Front Ends..... 177
Coal Briquettes and Their Use in Railroad, Marine and Domestic Service.... 184
Cost of Handling Locomotive Coal and Ashes 191
Foreign Railroad Notes:
Stations on the Chinese Eastern..... 172
Railroads in Siberia. 176

GENERAL NEWS SECTION:

Traffic News 193
Equipment and Supplies 200
Railroad Officers 207
Railroad Construction 208
Railroad Financial News 210

VOL. XLV., No. 3. FRIDAY, JUNE 19, 1908.

During a little more than the last half year and since the panic of last October, twelve railroad corporations have returned an increase of some 26,000 in the number of their shareholders or about 20 per cent. and the returns do not include several of the larger railroad systems of the country. It is a conservative estimate that the railroad shareholders of the country now number at least 300,000, probably half of them voters. The figures are, of course, subject to diminution when one voter holds shares in several railroads. But, on the other hand, there is the plus sign when a trustee represents several holders. There is the army of holders of railroad bonds presumptively also reinforced during the last seven months and another huge army of the holders of corporation stocks not railroad. Saying nothing of the interest of employees in the properties for which they toil, are we not reaching a point where merely in its normal and valid relations to the electorate the railroad interest, so vehemently attacked, becomes something for even the politician to consider at elections? In the gallery to which the demagogues—and sometimes larger men—so persistently play, is often the man under whose fustian jacket rests, metaphorically, the railroad security. Or, if the security isn't there, it is in the savings banks to secure his hard-earned deposit. It is hardly premature to remind the leaders who "play politics" against the material interests of the land of the influence of his savings bank deposit on the voter in the free silver campaign of 1896 and also of the sensitiveness of the pocket nerve in that waxing body of electors which the distribution of stock-holdings connotes.

"The electro-gas signal does not now meet with the favor it enjoyed at first." Apparently, this careless sentence, whatever it may mean, is quite incorrect, and yet it appeared in this paper a few weeks ago. Having given a wrong impression to the reader, he may fairly expect a somewhat full statement of the facts. All the facts as to certainty of operation of the different forms of automatic signals are not available for publication, although they exist. Having been allowed to examine the official records of some of the railroads on this subject, a general statement, sufficient to show that the statement was quite wrong, can be made, although we are not permitted to give the full statistics. One railroad company with over 2,000 semaphore blades operated by Hall electro-gas machines, has a record of less than one signal mechanism failure in 1,300,000 blade movements. There has been no failure in which the signal has shown clear when it should show danger. On another railroad, with a large installation of Hall electro-gas signals, they report as a percentage of efficiency 99.98. Still another report shows no failure to clear, and only one failure to danger in more than 73,000 movements. The first installation on the Putnam division of the New York Central, 34 signals, has been in service about four years. It has a record of two years with no failure. Three failures were reported when the electric trains were put in service on the electric division. The heavy voltage current from the nearby electric zone lines temporarily interfered with the control of the relays at Van Cortlandt Park. This trouble was promptly corrected. It is interesting to note from the reports of different railroads that the tanks containing 50 lbs. of liquid gas have averaged records varying from 7,600 to 8,000 movements per tank. We are told that it is considered good practice to remove the tanks before the pressure is reduced much below 200 lbs. pressure. This does not cause loss of money, for the reason that the road pays only for the amount of recharging necessary to make a full 50 lbs. The cost of the gas is about 4 cents a pound. It seems wrong, after several years of use of different forms of automatic signals, that the information is not available for making comparisons of the cost of maintenance and operation. Standardizing the method of keeping these accounts would seem to be a function of the Railway Signal Association.

Railroad employees in Nebraska, in forming an organization to oppose further unfair regulation of railroads and sending a committee comprised of representatives of the employees of all lines in the state to appear before the state railroad commission to protest against a proposed general reduction and readjustment of freight rates, have set a good example. Advocates of drastic reductions of railroad rates and earnings usually have talked as though, if anybody was hurt, it would

only be railroad stockholders; and stockholders at present have few defenders. But railroad employees are awakening to the fact that dividends and wages are paid from the same treasury and that whatever curtails the one is pretty sure to reduce the other. In opposing unreasonable cuts in rates, railroad employees act not only for their own interest, but for the good of the rest of the community. The manufacturer, the merchant and the farmer gain something directly by having freight rates unreasonably low, but they lose indirectly a good deal more. When the railroads are not prosperous and the amount paid by them in wages is reduced, the 1,500,000 railroad employees and their families who are scattered throughout every part of the country have to curtail their purchases at the city and country town retail stores. The retail merchants, in consequence, buy less of the jobber, the jobber buys less of the manufacturer, the manufacturer lays off labor and buys less raw material, and the demand for the products of garden and farm declines. Unfair attacks upon an industry so large, having such extensive ramifications, and having so many industries, directly or indirectly, partially or wholly dependent upon it as the rail transportation system of the United States, causes severe and diverse economic derangements that hurt more or less every individual and industry. The many thousands of railroad employees cannot under present conditions better serve themselves and the public than by studying carefully the railroad situation and then taking a hand in the campaign of education that is vitally needed to enlighten public sentiment and to get into law-making bodies and on railroad commissions men who will substitute intelligent, just and businesslike regulation of railroads for ignorant, political regulation.

Probably a majority of American railroads are using self-cleaning front ends on their modern motive power. Out of 26 of the larger roads which were recently asked concerning their practice in this respect, 12 are using a self-cleaning arrangement and the motive power officers of a number of the others thought this arrangement the most desirable, although for one reason or another they had not adopted it. The troubles with the non-self-cleaning type are well known, and include the ignition of the cinders due to leakage of air around the cleaning hopper and door, with consequent burning of the smokebox and door; impairment of free steaming due to loss of vacuum from air leakage; delays on the road to dump cinders; setting fire to packing in front truck journal boxes in dumping red hot cinders, and other evils, all of which self-cleaners avoid. The experience of American roads with extension fronts for the entrainment of cinders has often been called a fad which wasted lots of time and money before its fallacy was discovered. In the non-self-cleaners now used it is obvious that the smokebox can hold only a fractional part of the cinders drawn through the tubes between terminals, the rest being ejected; therefore, say the self-cleaning advocates, all of them might as well be thrown out. One road which investigated this matter carefully found that while the average amount of cinders collected in the smokebox varied with the class of engine, length of run and kind of coal, the largest amount removed from any engine did not exceed 10 bu., and the average was less than 4 bu. Even the larger quantity would be generated in the first few miles of a run, and for the remainder of the trip the cinders would go out of the stack, so that the locomotives are, after all, essentially self-cleaning. As an experiment the hoppers on some of the larger engines of three different classes were sealed up and they ran from one to three weeks successfully without cleaning.. With an equipment of about 1,500 locomotives this road renews about 300 hoppers a year at an average cost of $5 for removing the old hopper and applying a new one, or a total cost of $1,500 a year for this item. The law department of this road gave the opinion that the removal of the cinder hoppers would not have an undesirable effect in fire damage suits. Since in such suits it is usually a part of the defense to show that the front end arrangement of the locomotive conforms to good practice as determined by the usage of railroads in general, the 26 roads referred to at the beginning of this paragraph were asked to give data regarding the netting or perforated plate used in the front end. This information is tabulated elsewhere in this issue.

CASE-HARDENING LOCOMOTIVE BEARINGS.

In the various methods of reducing the cost of locomotive repairs per engine-mile an apparent economy has been shown by prolonging the time between repairs, and thus obtaining a larger mileage for a given charge and a smaller unit cost. The time a locomotive will remain in service without general repairs, and its economical performance during the latter part of this period, have an important relation to the quality and condition of the smaller pin bearings, such as those in the valve gear. This is becoming more evident as the Walschaerts gear requires repairs, as it is made up largely of pin bearings, and the effect of wear is so pronounced that the tendency is to use larger pins in later designs.

The service to be obtained from such bearings depends upon the quality of the case-hardening and the accuracy of the finish. The ordinary process of case-hardening is the same now as when locomotives were first built, and it is probably the crudest metallurgical process connected with locomotive manufacture. Some little improvements have been made in the furnaces and the packing cases; but under the most favorable conditions, case-hardening by the use of carbon in the solid form is slow, irregular, uncertain and expensive, and consequently it is generally an unsatisfactory method. The effort is to increase on the surface and to a slight depth, the carbon content of iron or low carbon steel to such an extent that when quenched it will be as hard as tempered steel. The articles to be hardened are packed in an iron box with material rich in carbon, such as charcoal, scrap leather or bone. The box is tightly sealed and placed in a furnace, where it is heated to a temperature of about 1,500 deg. F. This high temperature expands the metal so that the surface portion combines with the surrounding carbon; but this action is very slow and ordinarily requires 20 to 24 hours. With most furnaces the temperature is uncertain, depending upon the weather and the draft of the chimney. The carbonaceous material nearest the pieces is soon exhausted and there is a slow passage of carbon through it from the fresher material. The surface of the metal which has been slightly carbonized also prevents to some extent the further penetration, and all these conditions combine to make the process slow and uncertain, and deep penetration requires either prolonged heating or repacking with fresh material.

The small capacity and the time and expense connected with this method of hardening bearings renders it of rather limited application, and even for locomotive details it is not used to as full an extent here as in other countries. In some English locomotive works it is the general practice to case-harden the journals of tender axles, and they are then ground and polished, making an ideal bearing surface, similar to that obtained when driving journals or main rod pins have been used several months without heating. In the same foreign practice the case-hardened pins and bushings are accurately ground and fitted on special machine tools designed for this purpose.

In this country so much care is not taken, as the case-hardening extends to a slight depth, and if the piece is distorted the grinding must render the hardened surface irregular in thickness. When pins and bushings are roughly fitted, without grinding, the slight distortion due to case-hardening must produce uneven bearing and irregular wear, resulting in a shorter life. The quality of such bearings thus depends upon the depth and regularity of the case-hardening and the accuracy of the finish and fitting. If they are soft or badly

fitted they will become worn after a small mileage, and if not renewed will introduce such irregularities into the valve motion as materially to affect the steam consumption or compel a shopping before other portions of the engine require repairs.

The extensive use of the Walschaerts gear renders it more important than heretofore that the case-hardening of pin bearings be more uniform and certain than is ordinarily obtained by the old process. It is fortunate, therefore, that a new process of case-hardening has recently been introduced which promises to overcome the objections which are above referred to, and which produces more rapid and certain results with less expense. The gas process of case-hardening has been developed by A. W. Machlet, superintendent of the American Gas Furnace Co., Elizabeth, N. J., and the apparatus is made by that company. Another company at the same place is now engaged in executing, by the new gas process, orders for case-hardening for the trade.

A permanent firebrick-lined retort is used and the time and expense required for packing and repacking are saved. The carbon is supplied by a current of carbon-laden gas under pressure, the work is agitated by the rotation of the retort and the exhausted gas is conducted away while fresh gas is admitted. The supply of carbon is thus made continuous and deep case-hardening is effected in a moderate time. After the carbonization is effected, the articles are allowed to cool and are again placed in the retort and heated to proper temperature for the hardening bath. The quenching process is also kept under better control by the use of special apparatus, and the change of temperature of the whole piece is made more uniform and regular.

While case-hardening may be regarded as one of the minor methods connected with the construction and repair of locomotives, it really has an important influence upon their service and economical performance, and for this reason it is worth while to call attention to the new method of gas case-hardening which promises to substitute for present practice something in every way more satisfactory.

LOCOMOTIVE RATIOS.

In laying out the plan for a locomotive the designer must keep in mind a number of ratios, upon attention to which the successful operation of the machine depends. Some of these ratios are limiting as the result of the action of natural laws, while others, though really dependent upon natural laws, seem to be more or less arbitrary in character, are derived from experience and are subject to wider variations. For example, tractive effort, which is usually calculated on a basis of 85 per cent. of the working steam-pressure, should not be more than 25 per cent. of the weight of the driving wheels, else the engine will be apt to be slippery and have poor starting qualities. This ratio is based, of course, upon the coefficient of friction existing between the wheel and the rail. In practice on American roads this ratio between the tractive effort and the weight on the drivers averages about 4.75, although there are some wide variations from this, the range being from 4.00 to 5.84 and even 6.1. The 5.84 is that pertaining to a heavy 0-6-0 switching locomotive and the 6.1 to a high-speed express passenger Pacific (4-6-2) locomotive. This exemplifies the latitude that American designers allow themselves. The high ratio on the Pacific engine was undoubtedly used because of the desirability of having a large boiler to generate an ample supply of steam when hauling a heavy train at high speed. The 6.1 is for a prairie (2-6-2) locomotive for the same road. These figures also indicate the general tendency. That is to say, if the engine is intended for heavy hauling at slow speeds, the ratio is dropped as low as it is considered advisable, so that every available ounce of weight shall be used for increasing the drawbar pull, whereas if speed is the main object then the weight is raised as high as possible, so as to provide ample boiler capacity for high-speed work, and this maximum weight is now close upon 30,000 lbs. for a single wheel.

The American ratios are, however, undercut by some examples of foreign practice. For example, two cases of American-built locomotives for Japan have ratios of 3.65 and 3.73, respectively. There are also other examples where the ratios are less than 4.00. Thus England has some of 3.59, Denmark of 3.90 and Sweden of 3.81. The English practice apparently varies through a wider range than the American, as there are cases where a ratio of 5.97 is used. French practice also occasionally rises above 5.00 and the German usually lies between 4.00 and 5.00. These figures are indications of the liberties that are being taken in modern designs in order to meet special requirements. The use of ratios less than 4.00 is unusual, and is probably only used where light trains are to be hauled at high speeds and where the tractive effort exerted is usually well below the maximum.

Another ratio that is subject to rather wide variations is that of the proportions between the grate area and the heating surface. Under the old regimé 50 to 1 was considered to be approximately the proper ratio, and this with tubes of from 12 ft. to 13 ft. in length. With an increase in the length of tube it might well naturally follow that the ratio would be higher because of the decrease in the actual average efficiency of the heating surface, which may be considered to vary, approximately, inversely as the square root of the length. But, while the ratio of heating surface to grate area has been notably increased it does not follow that it goes with an increase of tube length. For, when the ratios of recent engines are examined, it will be found that long tubes are used with both high and low ratios, and *vice versa*. For example, a ratio of 1 to 79 is used in one case with 9 ft. 4 in. tubes, and on some Danish engines we find a 21-ft. 11-in. tube with a ratio of grate to heating surface of 1 to 59.2. This statement holds, however, better for foreign than for American locomotives, where there is a tendency to increase the length of the tubes and the ratio of grate to heating surface together, though even here there are wide exceptions. For example, a certain lot of 6-wheeled switches had a ratio of 1 to 93.5, with a tube length of 13 ft., but it may be taken to be common practice to use a 14-ft. or 15-ft. tube with a ratio of from 55 to 62, and when this ratio is increased to 1 to 70 the tube length also comes up to from 20 ft. to 21 ft., as in the case of two lots of prairie and Pacific locomotives, where the ratio is 1 in 71, although in another case we have the same ratio with a 12-ft. 3-in. tube and a 12-ft. 10-in. used with a 56.7 ratio.

Still another ratio that is subject to wide variations is that of the heating surface to the tractive effort multiplied by the diameter of the drivers, or, what is the same thing, the cylinder capacities. The range of variation here is quite as wide as in the others, and necessarily so, as it depends upon the total heating surface as one of its factors. Owing to the larger diameter of cylinders, as compared with the heating surface, it naturally follows that this ratio is higher with freight than with passenger locomotives, and average figures will run about 600 or a little less for high-speed passenger engines, about 800 or a little more for consolidation freights and above 900 for the Mallet compounds. These ratios also hold approximately, for foreign locomotives, though in the case of some English passenger locomotives a ratio of more than 1,000 to 1 is used—two-thirds more than the average of American practice for the same service. These figures are apparently more stable than the others and, being really a combination of them, show that the others have a certain constancy that does not appear at first sight. That there should be variations along all these lines is a necessary result of the widely differing services which the engines of the same class will be called upon to perform. Then, the variable of the quality of coal used enters as a modifying element that

would make changes of detail and of ratio necessary. But, in spite of these, the practice regarding the general proportions is more constant and well established than would naturally be expected, and it is probably that, as the carefully conducted investigations of the testing plant are carried on to greater elaboration, it will be possible still further to systematize the work of the designer. Even as it is, as stated before one of the railroad clubs some time ago, the builder simply wants to know the grades of the track, the weight and speeds of the trains and the quality of the coal that is to be used in order to build a locomotive that can be guaranteed to perform the work that has been laid out for it to do.

THE DESIGN OF ROLLER-BEARING CENTER PLATES.

The excessive flange wear of wheels under high capacity cars has led to the introduction of anti-friction center and side bearings on a few railroads, and sufficient experience has already been obtained to suggest some methods of improving the design. The results obtained from ball-bearing center plates show a substantial reduction in flange wear which must be accompanied by less train resistance and the combined economy should make it profitable to expend for anti-friction bearings a much larger sum than the cost of ordinary flat center plates. The question of the best way to spend money for an improved center plate has a close relation to the design as affected by the grade of the material, its quantity and the precision of its finish.

The two ball-bearing car center plates which have been used to the largest extent are somewhat different in design. One has balls 2 in. in diameter with bearings directly on the unfinished plate, while the other uses smaller balls 1½ in. diameter with bearings on inserted hard steel bearings. The ordinary formula for the safe working load for ball bearings is $P = fd^2$ when f is a constant 1000 for smooth surfaces and d the diameter. If we assume that the load on a center plate of a 50-ton car is 50,000 lbs. then the number of 2-in. balls required is $P = 1000 \times 4 = 4000$ and $\frac{50,000}{4,000} = 12\frac{1}{2}$, say, 13, and in like manner the number of 1½-in. balls required for the assumed load is 22. It has been found that in some instances the balls break and in others the bearing plates are worn or crushed. This results in the first case from the difficulty in tempering the balls, as the want of uniform temper increases with the diameter, the most satisfactory tempering being found with balls ⅝-in. diameter. The wear of the bearing plates may be due to soft material or to a concentration of the load on a few balls due to the tilting of the car in rounding curves. With the limited bearing area provided by balls it is especially important that when used in center plates the load be uniformly distributed and the top and bottom plates remain parallel. This condition is only secured by carefully adjusted side bearings having no loose vertical motion, and it is possible that the lack of such provision in connection with ball-bearing center plates has led in some instances to their rapid wear.

This experience with ball bearings has suggested the use of conical rollers for car center plates in order to secure larger bearing surfaces, and several of the roller bearing center plates which have been used rather extensivly on a few lines are illustrated in this issue. These plates are made of cast steel and are not machine finished. The rollers are drop forged low carbon steel and while smooth are not turned or ground. This condition of the surface has some relation to the number of rollers required, and it is quite probable that all the illustrations show a much larger number of rollers than would be required if the surfaces were finished or harder material was used. The ordinary formula for the safe load on roller bearings is $P = fdl$ where d is the mean diameter of the roller, l the length and f = 1,000 lbs. for finished surfaces. For a 50-ton car, having a load of 50,000 lbs. on one plate, we may determine the number of rollers required. If the mean diameter is 1½ in. and length 3 in, $P = 1,000 \times 1\frac{1}{2} \times 3 = 4,500$ and $\frac{50,000}{4,500} = 11 +$, say, 12 rollers. With smooth surfaces, hard steel bearings and a uniform distribution of the load, 12 rollers of the size given ought to be sufficient for one center plate of a 50-ton car. The experience with plates having 18 rollers of this size, but with unfinished surfaces, and steel of ordinary hardness, indicated that the bearing area was not too great and suggested the use of more rollers of larger size. Some of the roller center plates which we illustrate on another page are 5 in. long and have 25 rollers per plate, the extreme diameter of the roller circle being 15 in. Another design shows the roller 6¼ in. long, 33 rollers per plate, and the extreme diameter of the roller bearing 18 in. While such a large area of bearing surface may be necessary for heavy locomotive tenders which have a tendency to roll and shift the load so that it becomes concentrated on a few rollers, it must be more than necessary for 50-ton cars. The decision as to the number and size of rollers required for this service depends to a large extent upon the hardness of the rollers and of the bearing plates. We believe it will be found profitable to use for the rollers a grade of steel having higher carbon than 0.30 and to finish them on a special grinding machine where the work can be done at slight expense. To secure a harder bearing plate than is provided in the ordinary steel casting, one method would be to use a hard plate steel lining for both top and bottom center plates, but as the height is limited there might be difficulty from the bending of both linings and the metal back of it. Manganese steel castings would be well adapted to this service and in them the necessary hardness would be secured in the plate. The bearing surfaces of the plates could also be ground truly at a slight expense and with ground rollers the load would be accurately distributed and a very satisfactory bearing would be obtained. With the material and finish here suggested, a roller bearing center plate having the proportions of Fig. 1 should be amply large enough for the 50-ton car.

NEW PUBLICATIONS.

Die Dampflokomotiven der Gegenwart. By Robert Garbe. Quarto, 500 pages and 20 plates. For sale in this country by G. E. Stechert & Co., 129 W. 20th Street, New York. Price, $6.

Robert Garbe, an officer of high rank in the Prussian State Railroad service, who for some five years made a special study of superheated steam locomotives, and in this country examined and studied the performance of our most powerful locomotives, which he compares with the performances of German superheated steam engines, has prepared this stately volume of 500 quarto pages and 20 plates, which is substantially a treatise on "Modern Locomotives," and is doubtless the completed treatise on the use of superheated steam in locomotives. Here, we may say, that from such locomotives Garbe believes that the greatest performance may be had, without the gigantic proportions and the complexity which are so notable in recent constructions. Locomotive builders and users who are able to read German should not fail to make themselves acquainted with this book, some further account of the contents of which we hope to be able to give later.

Diamond Bars for Concrete-Steel Construction. By Edwin Thacher, Mem. Am. Soc. C. E. New York: Concrete-Steel Engineering Co. 44 pages, 6 x 9 in.; illustrated. Price, $1.00.

The greater part of this book is taken up with formulas for reinforced concrete construction. They are all based on the ultimate strength of both concrete and steel, with a factor of safety of four. It begins with several pages giving full results of tests for unit stresses, tests of concrete and of reinforced concrete beams, the bond between concrete and steel, etc. The rest consists mostly of tables and formulas of the strength, etc., of beams, slabs, columns and walls of concrete reinforced with Diamond bars. These are round bars on which are rolled longitudinal and interlacing spiral ridges.

Letters to the Editor.

FOR SAFE AND ECONOMIC CAR WHEELS.

Philadelphia, Pa., June 15, 1908.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

The article entitled "For Better Car Wheels" in your issue of May 18, 1908, by P. H. Griffin, who probably knows as much as any other manufacturer of cast iron wheels about the troubles occasioned by their use in all classes of service, and especially in the service required by modern freight cars of from 80,000 to 100,000 lbs. capacity, is a very candid admission that the cast iron wheel is not equal to the modern practice in transportation.

As he says, and says truly, "There is a greater appreciation than ever before of the necessity of bringing the order of practice as near as possible to the best standard on the part of all concerned." Mr. Griffin further says what is patent to all who know anything of the subject: "It (the cast iron wheel) has become more liable to failure through inability to support the load."

What does this mean? Simply that the cast iron wheel is not strong enough for the service required. If one has increased the power of a machine so that the cast iron frame is not strong enough, and, within the limits of space it cannot be made strong enough, the frame is made of a stronger metal. Where life and property are in jeopardy, as is the case in a moving vehicle at high speed, how much more reason is there to make a wheel of stronger metal, when it is admitted that the cast iron wheel is not strong enough, and this admission is borne out by statistics!

How much greater still is the reason for making it of stronger metal, such as steel, when it does not cost one-half as much per 1,000 miles in this class of service as the admittedly inadequate cast iron wheel?

As Mr. Griffin says: "Not only does this great reduction in the life of the wheels cause a heavy increase in the cost of operation, but the menace of accidents that must result from the large number of wheels that are constantly having to be removed for the defects described is very great. If the situation is to be relieved by the use of steel wheels, then railroads must certainly face a very heavy increase in first cost and maintenance charges."

We must join issue, however, with Mr. Griffin when he talks about heavy increase in cost and maintenance charges by the use of the steel wheel. In the light of the admission he has made and from data we have in hand, this assumption of increased cost of maintenance charges is erroneous.

As to the comparative cost per 1,000 miles under cars of 100,000 lbs. capacity (the class of cars to which we are particularly alluding), a steel wheel weighing the same as one of cast iron will give more than nine times the mileage which can be obtained from a cast iron wheel. This is indicated in the following table showing actual wear of Schoen solid forged and rolled steel wheels.

	Average wear per car.	Average mileage per car per 1/16-in. wear in radius.
Car No. 2106.....	0.0665	31,565
" " 2169.....	.1218	20,727
" " 2411.....	.0954	25,305
" " 2442.....	.0851	26,513
" " 2480.....	.1156	25,620
" " 2592.....	.1032	26,267
" " 2623.....	.1218	24,601
" " 2670.....	.0957	26,907
" " 2693.....	.0957	20,664
" " 2899.....	.0833	29,973
" " 4135.....	.0733	30,543
" " 4158.....	.0907	25,134
" " 4168.....	.0936	28,585
" " 4185.....	.0758	22,355
" " 4282.....	.0970	27,573
" " 4330.....	.1150	22,386
" " 4344.....	.1020	23,806
" " 4603.....	.0907	25,796
" " 4678.....	.0895	31,757
" " 4773.....	.1280	16,604
Average, 20 cars..	.097	25,684

The above records were made under 100,000-lb. capacity cars running over an important trunk line. Schoen wheels under heavy postal cars show an average mileage of 109,018 before the first turning. Computing this on the relative mileage per 1/32 in. of wear shows that these wheels under 100,000-lb. capacity freight cars will give a mileage of 102,735 miles before the wheels will require turning.

Comparative Value of Solid Forged and Rolled Steel Wheel and Cast-Iron Wheel Under 100,000 Lbs. Capacity Cars.

Schoen Steel Wheel.

Mileage per 1/16-in. of steel wheel., miles	25,684.00
Allowance for turning, per cent.	33
Net mileage	17,208.28
	20
20/16-in. of wearing metal produce	344,165.6
Freight car wheels being of a uniform standard size and ordered in large quantities can be furnished at present for	$18.50
Cost of turning steel wheel twice during life, including labor cost of removal from, and replacement under car, estimated at	2.00
Total cost	$20.50
Less scrap value	4.50
Net cost of steel wheel for 344,165 miles	$16.00
Or,	
Cost per thousand miles of steel wheel	$0.0464

Cast-Iron Wheel.

Under the rules of the Master Car Builders' Association, the item for changing journal bearings and removing and replacing cast iron wheels on foreign roads is $3.62½ per wheel. but it is estimated that the cost of such work, when done on the home road, would be $1.25 per wheel. If, therefore, we assume that 25 per cent. of the replacing of cast iron wheels would be done on foreign roads and 75 per cent. on the home road, we would have as the result $16.46 for the replacement of 8.83 wheels which we take as a basis for the computation of the relative values as shown below:

From the best sources of information we find that the average mileage of cast-iron wheels under 100,000-lb. capacity cars does not exceed	35,000 miles.
No. of cast-iron wheels to produce mileage of one steel wheel	9.83
9.83 wheels at $3.75 each after deducting scrap value	$36.86
Cost of removing and replacing cast-iron wheels and replacing journal bearings, if work is done on home road (75 per cent. of 9.83 wheels) equals $1.25 x 6.60 wheels	8.25
Cost of removing and replacing cast-iron wheels and replacing journal bearings, if work is done on foreign road (25 of 9.83 wheels) equals $3.62½ x 2.20 wheels	7.98
Total cost of 9.83 wheels	$53.09
or	
Cost per thousand miles of cast-iron wheel	$0.1542
Cost per thousand miles of steel wheel	.0464
Saving per thousand miles by use of steel wheel	$0.1078
Saving per thousand miles per car of 8 wheels	$0.8642
Saving per car per annum of 10,000 miles	8.8424
Saving per thousand cars per annum	8.6240

Some of the railroads have adopted the plan of marking their 50-ton cars, when equipped with Schoen wheels, up to 55 tons, as the car is considered abundantly strong for this load when so equipped, thereby hauling 10 per cent. additional tonnage without hauling any additional dead weight. As it costs as much to haul dead weight as it costs to haul paying freight, this item is of large value.

There is a further economy in the use of the steel wheel of perhaps as much or more importance than this extraordinary economy in the cost of wheel mileage as shown above, namely, the elimination of the item of wrecks caused by broken wheels. The consequential damage from this source is difficult to compute, but the interruption of traffic, in addition to the actual destruction of property and the frequent loss of life, is certainly of the greatest importance, and of itself would seem quite sufficient even though there were no actual saving in mileage cost.

From the records of 4,000 cast iron wheels, we learn that they were withdrawn from service for causes as follows:

31.45	per cent.	slid flat.	3.58	per cent.	chipped rim,
3.53	"	shelled out.	1.75	"	chipped flange.
5.36	"	seams in tread.	.69	"	broken flange.
9.38	"	worn through chill.	.36	"	cracked plate.
6.44	"	worn hollow in tread.	.05	"	cracked bracket.
			.07	"	burst wheels.
37.14	"	worn flange.	.19	"	loose wheels.

The solid forged and rolled steel wheel eliminates the necessity for the removal of wheels under freight cars for practically all of the above causes. We are advised that slid flat spots in steel wheels roll out. If deemed expedient, the flange of the steel wheel may be worn down to ⅛ of an inch below the limit allowed for cast iron wheels before turning is required as the strength of the flange of the steel wheel is 6.7 times stronger than that of the cast iron wheel.

When this comparative statement as to the relative costs per 1,000 miles service is considered in connection with the statement of 4,000 cast iron wheels removed for causes as compared with the statement of 111,243 steel wheels and their

relative service, further comment would seem unnecessary.

Finally, Mr. Griffin says: "The broad fact is, however, that the use of heavy equipment is rapidly increasing and that some way must be found of bringing the car wheel up to the point of greater safety and durability without much further delay." He also lays great stress on the fact that the railroads are unwilling to pay prices for cast iron wheels that would enable cast iron wheel manufacturers to make a satisfactory wheel. As a matter of fact, however, the cast iron wheel makers claim they are making the best wheel that they can make, and inspection is as severe as it is possible to make it. If they were to make them out of charcoal iron or the highest grade of iron possible to get, the initial cost would run up pretty close to that of a steel wheel and even then the strength of the cast iron wheel would not be appreciably increased, certainly not anything like what the service requires. The difference in strength between cast iron and steel would still remain in the neighborhood of 5 or 6 to 1 in favor of the steel wheel. The truth of the matter is that railroad officials who study this subject are not convinced that a cast iron wheel can be made much better at any price.

J. E. Muhlfeld has gone into the subject of cast iron wheels rather exhaustively in an article published in the *Railroad Age Gazette*, June 12, 1908. His article is devoted mainly to the detail of design for a better cast iron wheel, together with recommendations, etc., as to the use of better material and foundry practice which the best minds have devoted to the subject for years past, but in spite of what he says the question is still open as to whether any improvement is possible. Certainly not until it has been done and thoroughly tried out.

It is natural for some people to cling to old methods until there is nothing left to cling to, and this disposition increases the difficulties of anyone making an effort to bring about real reforms. With relation to the steel wheel Mr. Muhlfeld quotes from his article published in the *Railroad Gazette* May 5, 1905, as follows:

"Considerable thought has been given recently to the advisability of substituting the steel wheel for the cast-iron wheel. The value of such a step is as yet only problematical. If steel wheels as manufactured to-day were used in place of good cast-iron wheels for freight cars the investment in the United States would be approximately $200,000,000 more than at present."

This statement requires us to quote from an article by the writer published in the *Railroad Gazette* July 7, 1905, as follows:

"Mr. Muhlfeld's statement that it would make a difference of $200,000,000 in investment if steel wheels were used is somewhat misleading, for the reason that the necessity for equipping cars of 60,000-lbs. capacity and under, does not exist, and is applicable only to 80,000 and 100,000-lbs. capacity cars. There are probably 200,000, or say, 250,000 cars of this capacity in use, and the additional investment for steel wheels over cast-iron wheels with which they are equipped, would probably not exceed $15,000,000 to $20,000,000, all of which would be more than saved in increased mileage, and in addition there would be safety from wrecks."

We still stand by what we stated three years ago.

In that part of Mr. Muhlfeld's current article headed "Comparison of Solid Steel and Cast Iron Wheels," he says: "The following shows the predominating deficiencies that may and do develop in solid steel wheels which correspond to those which occur in cast iron wheels and necessitate removal":

Solid Steel Wheels.	*Chilled Cast-Iron Wheels.*
1. Worn flange.	1. Worn flange.
2. Flat or blotched tread by sliding.	2. Flat or blotched tread by sliding.
3. Worn tread.	3. Worn tread
4. Shelly, flaky or brake-burned tread.	4. Shelled out or brake-burned tread.
5. Porous tread.	5. Spongy tread.
6. Cracked flange.	6. Seams at throat of flange.
7. Cracked plate.	7. Cracker plate and brackets.
8. Cracked tread.	8. Seams in tread, but not at throat of flange.
9. Broken flanges due to cracks and other causes.	9. Broken flanges due to seams and other causes.
10. Broken through hub and broken in pieces, but not through hub.	10. Broken through hub and broken in pieces, but not through hub.

We cannot agree in full with Mr. Muhlfeld as to this comparative list of corresponding deficiencies in solid steel wheels, and if they should occur at all the comparative percentage would be so insignificant as to be negligible. True, there will be worn flanges, but, as he admits that there is a strength of 5 to 1 in favor of the solid steel wheel, certainly there would be no danger from a worn flange, and furthermore, the wheel is not destroyed. They are intended to be turned up when such a thing occurs and at a very nominal expense a new wheel can be produced.

Second, the item of flat or blotched tread by sliding; this naturally would occur by too long application of the brakes, but we are creditably advised that ordinary slid flat spots roll out in steel wheels.

Third, the item of worn tread; naturally we expect worn treads from service but these are turned up and a new wheel is the result at a very small expense. Our records show that in the neighborhood of 100,000 miles of service is obtained prior to wearing the tread down to such an extent as to make turning a necessity.

Fourth and fifth, shelly, flaky or brake-burned treads; also porous treads; these may occur in steel wheels, but in nearly every instance a cut or two in the lathe makes a perfect wheel and the percentage would be very small.

Sixth, cracked flange; considering the difference in relative strength of the two metals, and also considering the fact that the steel wheel has the element of ductility which cast iron has not, this item is so far fetched that it should be eliminated.

Cracked plate, cracked bracket, broken flanges due to cracks and other causes; broken through hub and broken in pieces but not through hub; the items numbered from 7 to 10 inclusive are really so close to an improbability that they should be eliminated from the argument in view of what is stated above to the effect that out of 111,243 steel wheels in actual use under freight cars and tenders, only 129 have been replaced for defects, or, in other words, $99^{88}/_{100}$ per cent. of maximum efficiency has been obtained equal to a replacement of 0.012 per cent.

Mr. Muhlfeld states. "During a three years period recently ended, the performance of somewhat less than 300,000 33-in. diam. chilled cast iron wheels removed for all causes from all classes of service of locomotive tenders and passenger and freight cars averaged approximately 68,000 miles per wheel."

We presume he refers to the equipment of the Baltimore & Ohio Railroad, of which he is the General Superintendent of Motive Power. As this road has in the neighborhood of 88,000 cars which would represent a total in round figures of 700,000 wheels the percentage of wheels removed would be therefore over 42 per cent. But note the comparison between 42 per cent. and .012 per cent. as in the case of the steel wheels over a similar period of time. Furthermore, it must be taken into consideration that probably two-thirds of the wheels to which Mr. Muhlfeld refers are under cars of 60,000 lbs. capacity or less, which makes the mileage deductions misleading as a very much larger percentage would be chargeable to the large capacity cars.

He also admits what is an established fact known to everybody, namely: That the comparative strength of the new steel wheel with a cast iron wheel is about 5 to 1. Surely, then, in the one case there is abundant strength and safety where in the other case you are hovering on the danger line constantly, as is shown by the relative replacements of the two classes of wheels over the same period of time.

We quote again from Mr. Muhlfeld:

"The cost of handling, boring and mounting new, and to remate partly worn, cast iron wheels requires but few facilities and is an economic procedure as compared with the facilities and cost to do similar work and to return and regrind solid steel wheels."

Upon investigation we find that this statement is open to criticism. In the first place, there would be approximately 100,000 miles made by a steel wheel before turning would be necessary, on the average. The statement already set forth in this article regarding the cost of replacing cast iron wheels during the life of one steel wheel greatly modifies this statement of Mr. Muhlfeld's, as the cast iron wheel replacement occurs so often. All the additional facilities required for turning steel wheels are insignificant as compared with the ensured safety and increased mileage effected.

With regard to his statement about the great interest on the investment and differential in values and weight of the material in the new, second-hand and scrap solid steel wheels or present manufacture, we think is answered in the comparison we have made as to the relative cost per 1,000 miles for each class of wheels.

Mr. Muhlfeld advances an opinion:

"Until a one-mileage solid steel wheel, with hardened tread and flange wearing surface which will not involve the loss of material

and the labor expense and time required for returning treads and flanges and readjusting heights of cars can be produced having considerable less weight and greater service value than a good chilled cast iron wheel, and which can be sold on a specification, test, mileage and exchange basis, similar to the latter, the use of the solid steel wheel for freight service will be somewhat of a luxury."

This opinion is also answered in the comparative estimate made. We might add, however, that one might be playing with fire in the use of high tempered steel in the flange of a wheel. Then again we would be going into an unexplored field with all the probable dangers and leaving the known and tried chemical composition. Again it would hardly look reasonable to throw away a wheel when a new one could be made of it at a cost of 50c. to 75c., and it would not be economic to make a single-mileage wheel that would practically make only one-third of the mileage that another wheel would give which did not cost more than about 10 per cent. above the cost of the one designed for a single mileage. What we are advocating would indeed be a "luxury," a safe wheel without extra cost.

In the next to the last paragraph Mr. Muhlfeld says:

"It is advisable to confine its use for the present to purposes of economy rather than to unnecessarily increase the already too high operating costs of railroads."

The answer to this is that it must be economic for large capacity cars if it is for high-speed service.

Again he says:

"There is a great need for a perfected solid steel wheel to substitute the composite steel tired wheel now in general use for high speed service where the impact and braking conditions are especially severe."

This is an admission that the steel-tired wheel is superior to the cast iron wheel, else why use them for this trying service? It is also an admission that a solid steel wheel is superior to a composite steel-tired wheel, else why recommend them in preference to composite steel-tired wheels? The subject seems to resolve itself into this: That if the solid forged and rolled steel wheel is the cheapest for large capacity cars it should be used. Records show that it is the cheapest and the more steel wheels that are used naturally the cheaper they will become. That it is on the whole safest is beyond question.

Finally, in summing up Mr. Muhlfeld argues that cast iron wheels are not properly made at the present time, and that the material in them is not good enough, notwithstanding the accumulated knowledge of 50 years.

Does it not appear then that a futile effort is being made to find a design or process, as yet undiscovered, to make cast iron do something which is beyond its capacity to accomplish? And is not this view supported by the fact that cast iron wheel makers are combining to force the railroads to relieve them from guarantees for wheels to go under cars of 100,000 lbs. capacity?

Is it then not fair to concede two points, viz.:

First, that steel is stronger and safer than cast iron for the service required?

Second, if neither cast iron wheels nor solid steel wheels are in a perfected condition, as Mr. Muhlfeld's argument would indicate, it is good business to encourage the development of a wheel made of the stronger metal?

The introduction of the large capacity steel car was a great stride in the direction of reducing the cost of transportation, but it has been said that "improvement without further improvement will not last." As the steel car caused most of the trouble with cast iron wheels it would seem to be in order for this additional improvement, the forged and rolled steel wheel, to take its appropriate place under the steel car, thereby completing it and relieving the situation regarding wheels where the greatest need exists.

CHARLES T. SCHOEN.

CHILLED CAST IRON WHEELS.

New York, May 16, 1908.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

The communication from J. E. Muhlfeld on chilled cast iron car wheels, published in your issue of June 12, is of the greatest importance, in view of the fact that he has devoted many years to study of the question, and that his paper covers a wide range of data connected with chilled car wheels and the service conditions under which they are used, and more particularly because he has stated without reservation so many vital facts on the wheel situation. The fact that Mr. Muhlfeld is a Member of the Wheel Committee of the Master Car Builders' Association, and, further, that the annual convention of the Master Car Builders' Association is being held at Atlantic City, gives an importance to his paper of the first degree.

In view of the fact that so little time was available between the issue of June 12 and the convention, I take the liberty of sending this communication to you, not as representing the opinions of other wheelmakers so much as of setting forth what I consider to be the situation with regard to a number of the facts referred to by Mr. Muhlfeld. It is also necessary to deal with the subject as frankly and unreservedly as Mr. Muhlfeld has done, in order to do it full justice.

Something must also be said in a preliminary way with regard to the position of the chilled car wheel makers, who, as representing the other car wheel makers of the country, have met the members of the wheel committee of the Master Car Builders' Asociation from time to time during the past few years. The wheel makers have no formal association.

In 1905 the situation with regard to guarantees, etc., had grown so impossible that there was a very large attendance of wheel makers from all parts of the country at the annual meeting of the M. C. B. Association, and the subject was thoroughly discussed by the wheel makers and presented to railroad officers, with the result that a committee of the M. C. B. Association, designated as the wheel commtitee, took the matter up and held further meetings from time to time with a committee representing the wheel makers. Since that time there has been more hearty co-operation between the railroad officials and the wheel makers than ever before, and an informal committee of about twelve wheel makers, representing the eastern and western manufacturers, was formed. This committee took up with the railroad committee the question of guarantees, wheel sections, etc., and the work of the two committees resulted in the adoption of a standard section of car wheels by the M. C. B. Association, after which time it was considered that the work of the wheel makers' committee had practically terminated. This committee, however, has been called on several times since then to meet the wheel committee of the M. C. B. Association, particularly about two months ago to take up the question of mixtures, possible modifications of the wheel sections, etc., in view of the fact that the service of chilled wheels under cars of heavy capacity was not satisfactory. The wheel makers' committee had but a few days' time to prepare any data on the subject, and it was not possible at that meeting to even speak in behalf of the car wheel makers of the country as to what would be recommended.

The work of the two joint committees referred to had most valuable results; namely, the adoption of the standard section of car wheels and the application of less onerous guarantee conditions. If the result of the work of these committees and the recent agitation of this subject on the part of the *Railroad Age Gazette* has now brought the result, and railroad officials of high position are now prepared to take up the matter effectively and support, with vigorous action, their mechanical and other officials, the result is of such an important character that the wheel makers now have good cause to believe that a better day is dawning.

To show the actual conditions that must be provided for, the conclusions presented by Mr. Muhlfeld may be commented on as follows, all matter in quotation marks being taken from Mr. Muhlfeld's paper:

"PROPOSED MIXTURE, ANALYSIS AND MANUFACTURERS' RESPONSIBILITY.

"In order to insure the desired efficiency and economy, the following is submitted for consideration in connection with the formulation of a proposed revised specification:

"MIXTURE.

"All wheels should be made of not less than 40 per cent. charcoal iron and 60 per cent. selected old wheels and foundry scrap, as follows:

"10 per cent. Salisbury, Conn., Lime Rock, Haman or Hunts-Lyman furncase; White Rock, Va.; Reed Island, Va.; imported Swedish or equivalent irons.

"20 per cent. Shelby, Ala.; Rock Run, Ala.; Blue Ridge, Ga.; Cherokee Ga.; or equivalent irons.

"10 per cent. Lake Superior low sulphur charcoal pig from Bessemer ores or equivalent irons.

"60 per cent. selected old wheels, wheel heads, gates, sprues, rough pig and foundry scrap from wheel heats.

"100 per cent. total.

"The use of malleable and cast scrap and of ferro-manganese will not be permitted.

"ANALYSIS.

	Per cent. Desired.	Per cent. Limit.
"Combined carbon	0.75	0.90
Sulphur	.08	.10
Phosphorus	.40	.45
Manganese	.40	.45
Silicon	.60	.70"

From 15,000 to 20,000 chilled wheels per day are required for renewals and repairs in this country, and it requires at least one ton of mixture to produce three wheels, for the reason that about 10 per cent. of the iron melted goes into sprues, runners, heads, etc., and to that extent must be used later as scrap.

Fifteen thousand to 20,000 wheels would call, therefore, for the melting of 5,000 to 7,000 tons of iron per day.

Sixty per cent. of this amount would consist of remelted scrap wheels, leaving at least a requirement of 2,000 tons of new charcoal iron per day, if 40 per cent. of such material was specified.

Not over one-half of the iron made in charcoal furnaces is suitable for use in chilled wheel manufacture, unless iron or steel low in carbon is used to harden the mixture, which practice Mr. Muhlfeld specifically prohibits. Therefore, about one-half of the total amount of charcoal iron that could be manufactured would have to be used for other purposes, as it always has been, leaving the remainder available for chilled wheel manufacture. It may readily be seen that there would be a great shortage of charcoal iron on account of these facts, and that if the introduction of new wheels made of such mixture proceeded very rapidly there would be a serious question of finding at the present time, especially, sufficient charcoal iron of the proper quality to enable the operation to be carried on.

Mr. Muhlfeld proposed the use of 10 per cent. Lake Superior charcoal iron, 10 per cent. Salisbury, southern or equivalent charcoal iron and 20 per cent. southern or equivalent iron, and also that the Lake Superior iron should be made from Bessemer ores.

The production of irons named stands in about the proportion to total production of two-thirds of Lake Superior to one-third of all other iron, and it therefore follows that there will be a great shortage of the latter, and that wheel makers located convenient to the source of supply of the Salisbury and southern or equivalent iron might obtain a sufficient supply, but that other wheel makers will be placed under a great disadvantage. No doubt, with a well-established and assured demand for high-grade charcoal iron the manufacture of such irons would start up again, but after many years of unprofitable operations in the manufacture of iron of this class it has gradually died out throughout the country to its present limits. In the Lake Superior district the manufacture of iron has increased during the last five to ten years owing to the fact that a large supply of wood for making charcoal is available, and also to the fact that the manufacture of wood alcohol and other by-products aided in the development of the operation. At the Lake Superior region the charcoal industry is now at the highest point of possible capacity that has ever been developed, and it is probable that if there is a sufficient demand at satisfactory prices for a high grade of charcoal iron that carbonate ores, suitable for mixing with the Lake Superior ore would be brought into that district, and iron of the desired class produced. The proposed specification that the manufacture of Lake Superior iron is to be confined to Bessemer ores, although no such restriction is placed on the other irons named, is rather remarkable.

Charcoal iron can be made from Bessemer ores, but high chilling charcoal iron made strictly from such ores, if not problematical, would be quite a new product. Mr. Muhlfeld's specifications contain analysis limits that would also make it extremely doubtful whether wheel makers could obtain Salisbury or southern iron to use in the percentages named that would give the analysis specified in the wheels. If railroads will clearly indicate that they are prepared to pay the price for new wheels that will admit of the use of such materials, there is no doubt that progress will be made in the near future toward the re-establishment of the charcoal iron industry on a sufficient scale to meet the demand.

There is no doubt that carbonate, or brown ores, as they are generally called, could be delivered in the Lake Superior district at about $6 per gross ton, and that the use of 50 per cent. of such ores and mixtures would produce an iron possessing all of the advantages found in Salisbury, southern and Lake Superior irons. If 50 per cent. of such ores were used, the cost of the iron made would not be increased very much per ton. In view of the fact that the best grades of southern and Salisbury iron bring higher prices than Lake Superior iron, this would seem a very good business for the Lake Superior iron manufacturers to take up.

This is no argument for or against the use of Lake Superior irons, southern or any equivalent character of iron, but it is simply a statement of the practical possibilities in the matter as they appear to the writer, and the manner in which the whole situation could be dealt with quickly if the railroads are earnest and determined in their purpose to adopt the policy of specifying large proportions of new charcoal iron, and at the same time of leaving the wheel makers and charcoal manufacturers in a position where it could be obtained.

No purpose whatever will be served by having railroads adopt specifications covering conditions it is impossible for the car wheel makers to carry out, leaving it to the wheel makers to find the way out of such a dilemma. In such a case, as in too many others that have prevailed, the manufacturer of chilled car wheels with the easiest conscience would probably get the larger part of the orders; but the railroads would not get the wheels required or specified because it would simply be an impossibility to make them on a large scale.

Mr. Muhlfeld's specification also proposes exclusion of malleable and cast iron and steel scrap and of ferro-manganese. There is much to be said on this point, and the writer fully agrees with Mr. Muhlfeld as to the necessity of eliminating the use of such material, but to forbid it without any preparation would simply put wheel manufacturers that lived up to specifications in an impossible position again. If the use of such material is to be eliminated, the first necessity is to have the wheel maker receive a price for his wheels that will enable him to discontinue the use of the objectionable material, and there is not the slightest doubt that any and all wheel makers would be delighted to do so.

Railroad officers should regard these conditions and facts and be careful how they decide on a course of action that would perhaps put the whole problem theoretically up to the wheel makers without the slightest benefit to all concerned. Such a course would simply make a bad situation worse. No doubt many makers will readily say that if they receive a sufficient price for wheels they will guarantee to deliver wheels that will stand present conditions of service, no matter what they are, because such wheel makers would figure that the additional price would enable them to cover additional charges on guarantees for failures, if they occurred; but railroad officers must remember that their greatest concern is to obtain a good wheel, and that no matter what the promises of a wheel maker may be the actual practical knowledge possessed and used in the work under his control will determine the question. A great improvement can certainly be made at once by any wheel maker by the use of good material, and such improvement in its practice as he is able to make; but statements to the effect that a proper price being made will enable the delivery of wheels that will not be subject to cracking in the tread and flange by brake heating certainly represent a belief rather than such a possibility.

There is no doubt that certain changes can be made in the apparatus or method of applying brakes, or wheel construction that will relieve axles from excessive brake heating in certain particulars, and toward the accomplishment of this end every effort should be directed. To control a 50-ton freight car on a heavy grade brake friction develops a degree of heat that would in time destroy any metal when repeated day by day, and the continual cooling of the heated wheels in rain and snow in certain seasons also produce detrimental changes in the structure. After these general observations the following further comments may be made on Mr. Muhlfeld's conclusions:

"Modify the guarantee feature now generally included in the specifications and particularize the mixture or analysis, or both, to insure a quality of material that will give adequate strength and resistance to heat effect from brakes, as well as uniform wear."

Modification of guarantee conditions is most desirable for

railroads and wheel makers, because present guarantees are impracticable, but to particularize mixtures and analysis is a matter that should be considered and arranged with very careful consideration of all results involved. To incorporate a provision calling for the use of material that would give adequate resistance to heat effects from brakes would be bold, even if an impossible remedy. It would shift more responsibility on the wheel maker, but it is difficult to say what the railroads would gain.

"Incorporate a manufacturer's responsibility clause which will assure good foundry practice from the time the work on the patterns and chillers is commenced until the wheel is removed from the annealing pit."

To incorporate a manufacturer's responsibility is somewhat an indefinite matter. This, it seems, should come under the head of proper inspection on the part of the purchaser to insure the fact that good foundry practice was carried on.

"As the form of the wheel pattern with respect to contour of plates or brackets and in the distribution of soft iron will obviate flange, tread, rim, plate and bracket defects which may occur in manufacturing and result from friction or impact during service, an improvement in the present generally used design, for the purpose of readily and properly dissipating heat and to provide greater flexibility, should be given consideration."

Mr. Muhlfeld may believe that changing the form and section of the present standard would obviate cracks in tread and flange, and as he has carried on considerable experiments in making changes of various kinds in standard sections, he may be able to prove progress. The observation and experience of the writer has never indicated that better results will be obtained in these particulars from the alteration of the present standard lines. The vital defect to be overcome at present is one which immediately concerns the wearing effect of surface of tread and flange and the alteration of the central part of the wheel will not remedy that. So far as defects in rim, plate, bracket, etc., are concerned in proportion to all wheels used, this percentage is being lowered instead of increased year by year. Mr. Muhlfeld refers in his article later on to certain alterations in the curves of the bracket of the M. C. B. standard pattern. The curve of the bracket recommended by Mr. Muhlfeld has been used to the knowledge of the writer in the work under his charge and in the works of eastern wheel makers for a number of years. There is no doubt that the increased curve of the bracket, as recommended by Mr. Muhlfeld, is along the correct lines, but it certainly is not a matter that has not been tested, worked out and demonstrated in practice.

"Adequate coning of the tread, the ratio depending on the curvature of the line to be traversed, will reduce the train resistance as well as the percentage of wheels taken out of service for flange wear and result in their removal for tread wear, which will yield the greatest mileage."

On the point of coning treads general experience and practice in recent and earlier years has never indicated, so far as the writer has learned, that any permanent advantage would be gained over present conditions of practice. Increased coning certainly may give advantages in some respects, but it produces disadvantages in other respects that are quite as important. This, however, is a matter for the railroads to work out—not one which the car wheel makers should be called on to give guarantee for.

"The radius of the fillet at the throat of the flange should be restricted to that which is permissible for the proper depth of chill without increasing the texture of the metal, as enlargement produces concentrated frictional contact between the throat of the wheel flange and the rail increases the liability for a full flange climbing sheared rail when traversing curves of considerable super-elevation."

Present practice is founded on long experience and the result of the same. The writer has never seen anything to indicate that increasing or decreasing the throat radius for present service conditions would produce better results, but this again is a matter that concerns the railroad companies, and if they desire to carry out experiments, the wheel makers should not be called upon to take the responsibility.

"Re-annealing removes inherent strains, gives greater freedom from cracked and broken plates under severe braking service and toughens the chilled portions of the tread and flange."

The practice of re-annealing car wheels has never been carried out to any extent, although believed in and carried on by certain manufacturers. For Mr. Muhlfeld to state that re-annealing will remove all strains and give freedom from cracked and broken plates is a pretty strong statement, for the writer has seen re-annealed wheels that are about as defective in these respects as any on which the process was not carried out. There is quite a misunderstanding about the matter of so-called annealing of car wheels. Chilled wheels are not annealed when placed in pits, but the heat of the wheel is simply equalized. On account of the fact that the temperature of the tread and flange is lowered by the process of chilling, it is necessary to equalize the heat throughout the wheel while it is still at a very high heat, and on account of this fact the wheels are placed in pits and the object accomplished. There is no doubt that in the manufacture of 700 and 750-lb. wheels the section is so heavy that certain changes in this important detail of wheel manufacture will be necessary, but, in the opinion of the writer, that will lead to a less time to be occupied in the process of cooling rather than to a greater time.

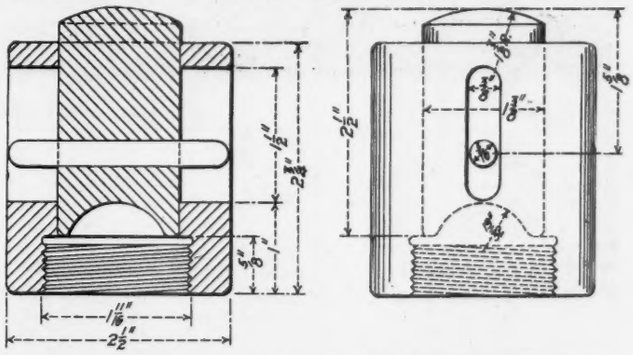
"More attention should be given to the concentric, smooth and true boring and to the accurate retaping when mating new as well as second-hand wheels; to the mounting of wheels with proper pressures to exact positions on axles with smooth, parallel wheel seats and to the maintenance of correct axle centers of trucks."

The writer fully agrees with Mr. Muhlfeld in this paragraph, and all of the remaining ones, that a better order of results can be obtained by a more careful order of practice and methods in fitting up wheels and of all the apparatus on cars on which the service of wheels depends; but it is unnecessary to comment on these conclusions, as railroad officers understand them so thoroughly. Mr. Muhlfeld's article only came under the observation of the writer on June 14, and the time available for a complete answer is necessarily short.

P. H. GRIFFIN.

METHOD OF APPLYING FLEXIBLE STAYBOLTS TO LOCOMOTIVE BOILERS.

At the recent meeting of the International Master Boiler Makers' Association the method of applying flexible staybolts, as used in the Rogers Locomotive Works, was described by R. V. Anderson, assistant foreman of the boiler shop. The holes in the sheet are punched $\frac{1}{32}$ in. smaller than the diameter of the bolt at the root of the thread, and are reamed with a tapered reamer, which has a guide on the point which goes through the firebox sheet. There is a collar fastened on the reamer at the proper place near the head, which prevents it from going too far, allows $\frac{1}{32}$ in. for thread and makes all the holes exactly the same size. The bolts are run in with an air drill and driven almost home. They are then carefully



Sleeve for Holding on While Riveting Flexible Staybolts.

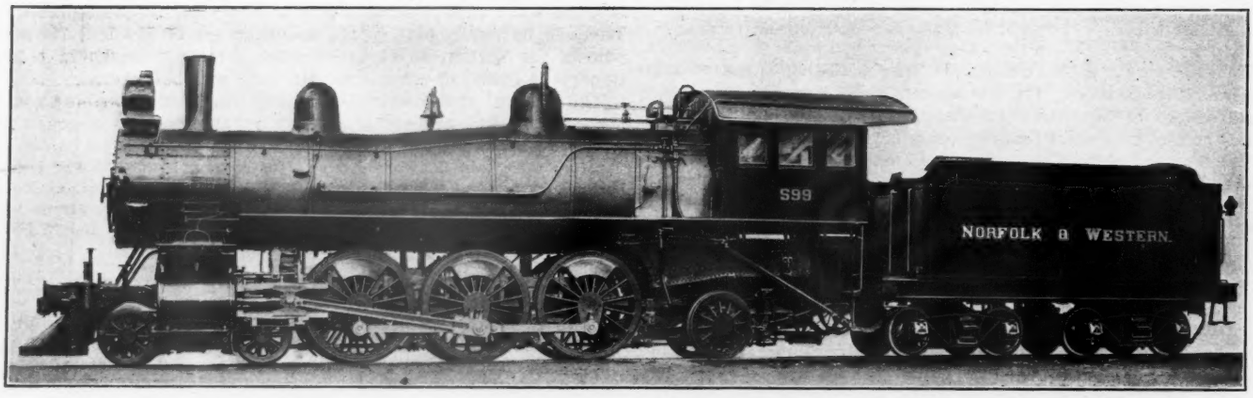
adjusted by hand, taking care to get an equal load on all bolts without pulling the firebox sheet out of line. While riveting the bolts a simple device for holding on is used, and it is illustrated in the accompanying sketch. This device obviates all danger of spoiling the thread on the sleeve. It consists of a nipple, which is screwed into the sleeve, and has a sliding plunger inside, which fits on the spherical head of the flexible bolt. The holding on is done by a sledge, which backs up on the outside of the plunger. Experience has shown that the most important thing needed in putting in flexible staybolts is good judgment. The holes, reamers, taps, bolts and sleeve may be perfect, but an injudicious or careless workman will spoil the work.

LOCOMOTIVES FOR HEAVY SERVICE ON THE NORFOLK & WESTERN.

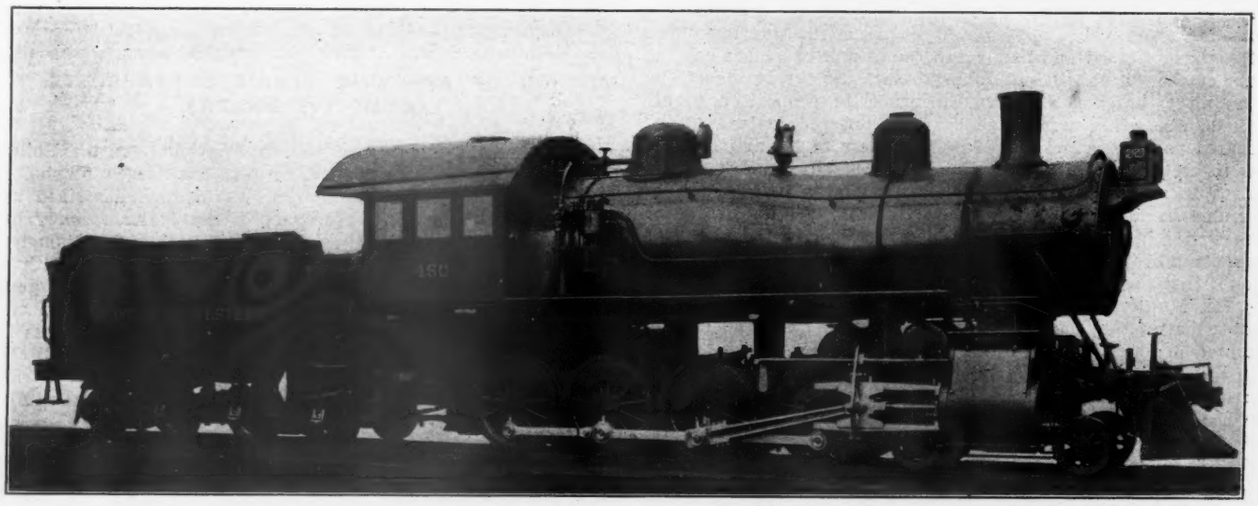
The heavy service on the Norfolk & Western is done by two classes of locomotives: a Pacific (4-6-2) for passenger work, and a 12-wheeler (4-8-0) for the freight. The Pacific engines, which are used for the heavy main line passenger trains, weigh 195,250 lbs., of which 125,000 lbs. is on the drivers. They are of the usual design, having no special features except the method of equalization and spring suspension at the back. Here instead of the yoke and helical springs, or the semi-elliptic over the trailing axle box, there is a yoke of the usual form attached to the end of a semi-elliptic at the back. The latter carries the frame on the spring band and has a bearing on the lower rail of the frame at the rear. At the front, the yoke carries the back end of the driver and truck equalizer. This is made in two bars and instead of coming to a solid bearing against the frame has seats for a semi-elliptic spring, which is carried by them and bears against the top rail of the rear extension of the frame. The equalization thus extends over all of the drivers and the rear truck, and semi-elliptic springs are used at all points.

A 60-car train is the standard for freight traffic, and these trains are hauled by 12-wheeled locomotives, double headed where the grades require it. They have 21-in. x 30-in. cylinders, and weigh 200,000 lbs., of which 168,000 lbs. is on the driving wheels. The standard engines are fitted with the Stephenson link motion, but two engines are now being tried with the Walschaerts gear. The engines are of ordinary design and have the usual characteristics of engines of their class. They are noteworthy principally because of the long stroke of the piston, as illustrative of the tendency of modern designs in that direction in contrast to the old stroke of 24-in. that was the standard for so many years on all classes of engines.

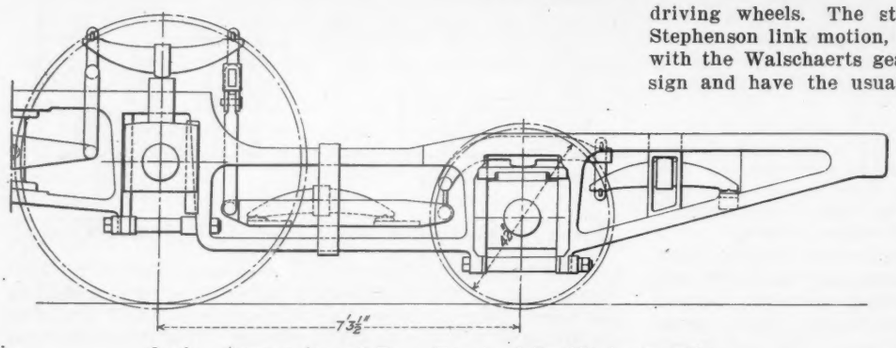
Another detail that is peculiar is the small diameter of the front truck wheels; this is but 27 in., a dimension somewhat smaller than that to be found in current practice.



Pacific Locomotive; Norfolk & Western.



Twelve-Wheel Freight Locomotive.



Spring Suspension of Rear Truck of Pacific Locomotive.

The following are some of the principal dimensions of these engines:

	12-wheel.	Pacific.
Cylinders, diameter	21 in.	20 in.
Piston stroke	30 "	28 "
Boiler, diameter of shell	70 "	67 "
Boiler, thickness of sheets	11/16-in.	.....
Steam pressure	200 lbs.	200 lbs.
Firebox length	100⅜ in.	99 15/16 in.
" width	64¼ "	64¼ "
" depth front	71 "	.....

Firebox, depth back	64 in.	.....
" thckns sides, back, crown.	⅜ "	⅜ to ½ in.
" tubesheet	⅜ "	½ in.
" water space front	5½ "	5 "
" " " back	4 "	4 "
" " " sides	5 "	4½ "
Tubes number	258	279
" diameter	2¼ in.	2¼ in.
" length	18 ft. 4⅞ in.	20 ft. 1 in.
Heating surface, firebox	173 sq. ft.	177.5 sq. ft.
" " tubes	2,778 "	3,286.2 "
" " total	2,951 "	3,463.7 "
Grate area	45 "	45.5 "
Wheels, diameter, driving	56 in.	68 in.
" " front truck	27 "	33 "
" " rear truck	.....	42 "
" " tender	33 in.	33 "
Journals, main driving	9½ in. x 10½ in.	8½ in. x 10½ in.
" trailing driving	8½ " x 10½ "	8½ " x 10½ "
" trailing truck	.....	8½ " x 14 "
" front truck	5½ in. x 10 in.	5½ " x 10 "
" tender	5¼ " x 9 "	5¼ " x 9 "
Wheelbase, driving	15 ft. 6 in.	12 ft.
" engine	26 ft. 5 in.	30 ft. 6½ in.
" engine and tender	53 ft. 6 15/16 in.	54 ft. 11 15/16 in.
Tank capacity, water	6,000 gals.	6,000 gals.
Tank capacity, coal	14 tons	10 tons
Weight on drivers	168,000 lbs.	125,000 lbs.
" total engine	200,000 "	195,250 "
" engine and tender	317,000 "	305,150 "
Tractive effort	40,162 "	28,000 "
Weight on drivers / Tractive effort	4.18	4.46
Total weight / Tractive effort	4.98	7.00
Tractive effort x diam. drivers / Heating surface	762.14	549.70
Heating surface / Grate area	65.58	76.12
Firebox heating surface / Total heating surface	5.86*	5.12*
Weight on drivers / Total heating surface	56.92	36.09
Total weight / Total heating surface	67.77	56.36
Displacement, 2 pistons, cu. ft.	12.02	10.18
Total heating surface / Displacement 2 pistons	245.51	340.24
Grate area / Displacement 2 pistons	3.74	4.47

*Per cent.

ROLLER BEARING CENTER PLATES.

The use of roller-bearing center plates under high-capacity cars and locomotive tenders has been growing gradually, and though little has been published in regard to this radical change in an important car detail and few if any illustrations of them have appeared, yet the manufacture of this type of center plate has become an important industry. The Santa Fe

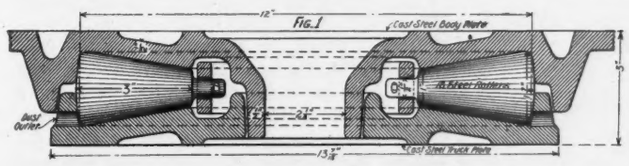


Fig. 1.

now has 9,000 freight cars, 100 passenger cars and 50 locomotives equipped with several forms of the Barber roller center plate, which are here illustrated, and the Burlington has made some laboratory experiments with them.

These plates are made of cast steel and the unfinished surface is cast so smooth that the plates are used in this condition. The rollers are drop forged steel, 0.30 carbon, and have no other finish than the cleaning received in the tumbling barrel.

Figure 1 shows one of the early designs where the rollers were made only 3 in. long and were connected together by an inner ring which fitted over the trunnion of each roller and held in place by a cotter key. This nest of rollers rests loosely on the bottom plate and when the top plate is removed the rollers can be lifted out. The total height of this pair of plates is only 3 in. Although the plate has 18 3-in. rollers having a maximum diameter of 1⅞ in., experience with this design appears to have shown the necessity of

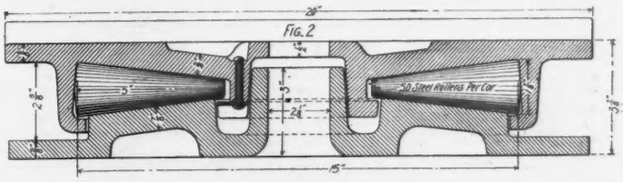


Fig. 2.

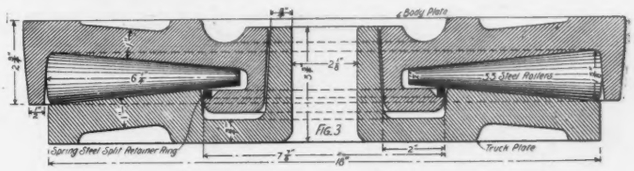


Fig. 3.

still larger bearing area and the convenience of having the rollers held securely in the top plate so that when the car body is removed from the truck, the roller bearings remain with it intact in the body center plate, and they are not liable to be mislaid by the various movements of the truck under repairs.

Figure 2 shows a plate designed to include such improvements. It has 25 rollers 5 in. long, and these are held in position in the upper plate by a lip on the outer rim of the plate and a ring ⅛ in. thick riveted to the inner flange. This form of plate has been used extensively under 50-ton cars with very satisfactory results.

Figure 3 shows a further development where 33 rollers are used, and they are made 6¼ in. long. They are secured in the upper plate by a simple device consisting of a spring steel split retaining ring which is found sufficient to prevent

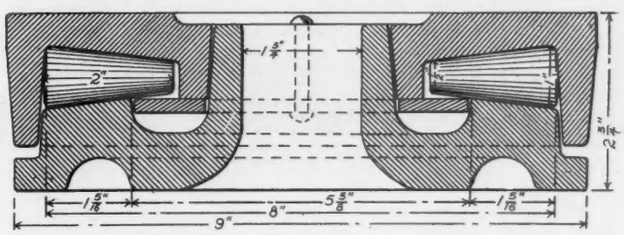


Fig. 4.

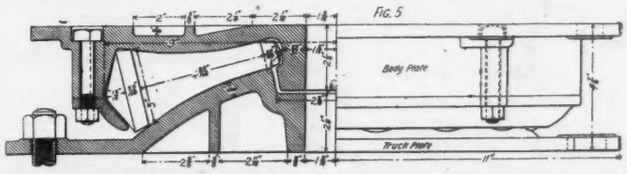


Fig. 5.

the rollers from tilting. When the ring is removed they can be shifted inward sufficiently to allow them to drop free from the outer flange. This type of plate is used for locomotive tenders and baggage cars.

It will be noticed that in these successive designs the thickness of the plate is increased; in figure 1 it is ½ in., in figure 2 it is ⅞ in., and in figure 3 the plates are 1 in. thick.

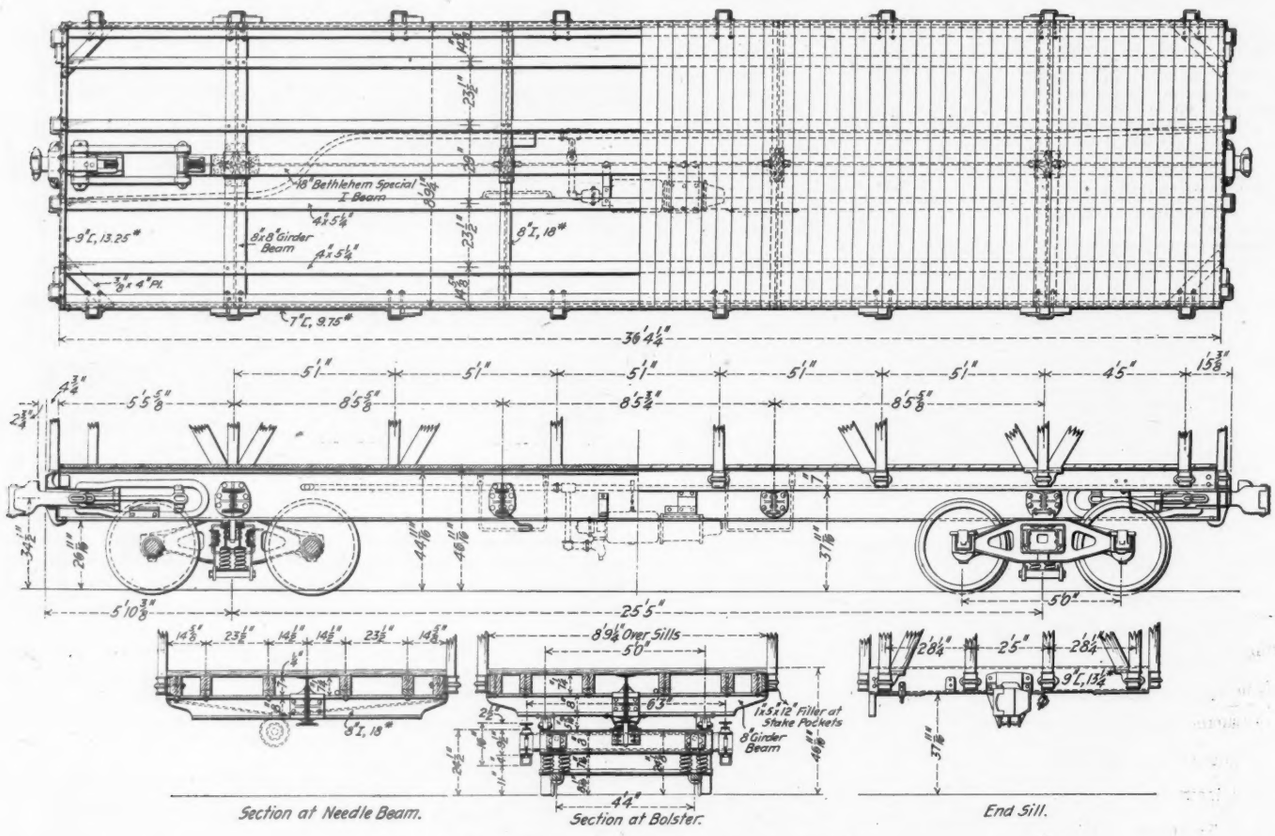
A small plate 9 in. over all and 2¾ in. deep, with rollers 2 in. long, is shown in figure 4. This is intended for heavy electric cars, and as these cars frequently traverse sharp

curves such a device should be well adapted to that service. All of the above are the Barber roller center bearings supplied by the Standard Car Truck Co., Old Colony building, Chicago.

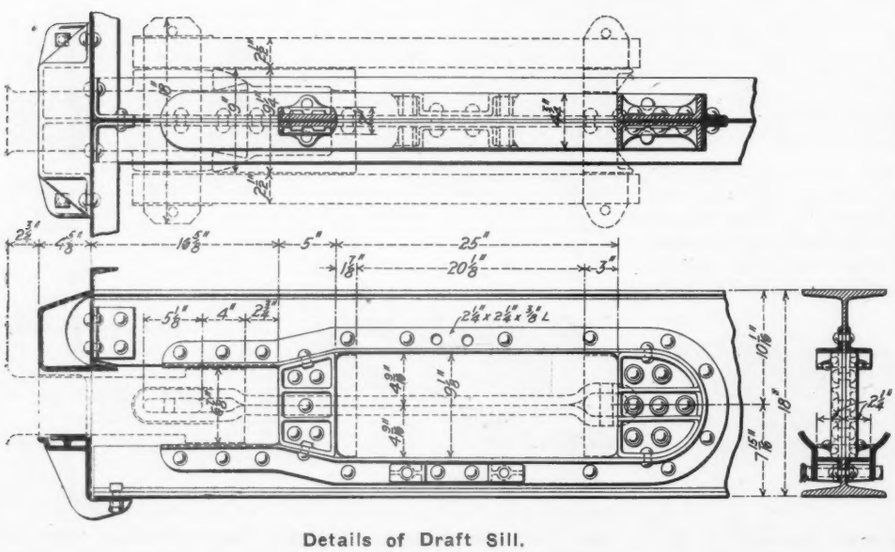
Figure 5 illustrates a roller center plate which includes the feature of retaining the rollers in the upper plate, and in this case they are secured by a circular flange which is bolted to the outer rim of the upper plate. The bottom plate is convex so as to make a spherical bearing and allow the rollers to adjust themselves to the motion of the car body on the side bearings. The rollers instead of being truncated cones have a concave surface corresponding to the curvature of the plates. There are 16 rollers in the set and they are guided laterally by the conical finish at the ends of each roller. This center plate is furnished by the General Railway Supply Co., Chicago.

STEEL UNDERFRAME STOCK CAR DRAFT GEAR.

One of the features of the new steel underframe stock cars, now building at the West Milwaukee shops of the Chicago, Milwaukee & St. Paul, which were described in the *Railroad Age Gazette* of June 12, is the application of the draft gear.



Plan, Elevations and Sections of Underframing.



Details of Draft Sill.

As shown in the accompanying illustrations, the car is of the single center sill type and the ends of the sill are cut away to receive the draft gear and coupler shank 2¼ in. x 2¼ in. x ⅜ in. angles, shaped like a drawbar yoke, are riveted to the sides of the center sill, reinforcing it at the cut out section. The malleable iron stop plugs are riveted to the web of the center sill, and these, with the yoke-shaped angle construction, form the draft pocket.

When the Russians built the Chinese Eastern Railroad, the stations for the large towns were established well outside of built-up streets. This has been charged to their expectation of war and their desire to fortify the stations; but as they have done the same in European Russia, it is more probable that they followed their custom and were willing to gratify the natives, who were shy of the foreign innovation. Now, the people want the stations nearer. At Mukden, with some 100,000 inhabitants, the station is three miles from the city. Here a Chinese, Chao-Ching-hsi by name, like an American promoter, saw his opportunity, organized a Chinese-Japanese company, and built a street railroad from the station into the city, which at present is worked by horses, and is said to be coining money.

COMBUSTION PROCESSES IN ENGLISH LOCOMOTIVE FIREBOXES.

At a recent meeting of the Institution of Mechanical Engineers, Dr. F. J. Brislee, of the Muspratt Laboratory of Physical Research, presented a paper on combustion in English locomotive fireboxes, based upon data collected in experimental trips on two engines of the "Experiment" and "Precursor" class on the London & North Western Railway. These two locomotives differ in size and depth of firebox, the firebox of the "Experiment" class being considerably larger than that of the "Precursor" class, and only about one-half as deep; hence the effect of working with a thinner fire will be seen from the analyses of the products of combustion.

Details of the London & North Western locomotives used in the investigations:

Type of locomotive	10 wheel
Class	"Precursor"
Weight, total	229,980 lbs.
Cylinders	19 in. x 26 in.
Diameter of drivers	6 ft. 3 in.
Boiler, working steam pressure	185 lbs.
" tubes, number	301
" " inside diameter	1 in.
" " length	13 ft.
Heating surface, tubes	1,908 sq. ft.
" " firebox	133 " "
" " total	2,041 " "

Type of locomotive	8-wheel
Class	"Precursor"
Weight, total	216,540 lbs.
Cylinders	19 in. x 26 in.
Diameter of drivers	6 ft. 9 in.
Boiler, working steam pressure	175 lbs.
" tubes, number	301
" " inside diameter	1 in.
" " length	12 ft. 2¼ in.
Heating surface, tubes	1,848.4 sq. ft.
" " firebox	161.3 " "
" " total	2,009.7 " "

The first work was done with the "Precursor" class. The engine was fitted with the usual apparatus for obtaining samples of smokebox gases and measuring the amount of vacuum and temperature.

From the results obtained it is evident that the loss due to the formation and escape of carbon-monoxide is greatest at comparatively low speeds, with late cut-off and strong blasts at long intervals as compared with much shorter intervals when running at high speeds, and at speeds of about 60 miles an hour, the quantity of carbon-monoxide in the products of combustion is practically nil. Further, in most cases, there was more than sufficient oxygen present to burn the carbon-monoxide completely, and the escape of this from complete combustion is due, in all probability, to the extremely rapid rate at which the gases are swept through the tubes and cooled down, so that the oxygen and carbon-monoxide had no time to combine. The presence of carbon-monoxide in the products of combustion at low speeds is due to the intermittent character of the air supply. The escape of the exhaust steam up the funnel takes place in a series of "puffs," and the interval between each "puff" varies with the speed of the train, hence the products of combustion are left in contact with the strongly heated fuel for a time interval depending upon the rapidity with which the "puffs" follow each other, and so partial reduction of the carbon-dioxide to monoxide takes place. Then, at the next "puff," the gases are drawn out of the firebox, along the fire tubes and into the smokebox before the complete combustion of the carbon-monoxide has time to take place. The effect of the gradient is that of reducing the speed of the train, thereby increasing the length of time between each "puff"; hence the time during which the products of combustion remain in contact with the incandescent fuel is also increased. The heavier the train, the greater is this slowing down when ascending a gradient; hence the proportion of carbon-monoxide which escapes combustion is greatest when the engine is working heavily, e. g., drawing a heavy train up a steep gradient.

The smokebox vacuum was measured with a U tube set in the cab. These measurements showed that the smokebox vacuum varied with the cut-off and the amount of throttle opening, as well as upon the resistance of the fire to the passage of the air. Under certain conditions it rose to from 10 in. to 12 in. of water, but the average was from 5 in. to 7 in., the higher figures being only occasionally reached and never held steadily. When the firedoor was opened for firing, the vacuum sank from $^5/_7$ in. to ½ in., the air entering freely through the open firedoor. At high speeds the vacuum was smaller, as a rule about $^3/_5$ in., but steady, and then the air supply approximated to a steady current, and combustion was complete, the amount of carbon-monoxide being very small or nil. In general, the tests showed that the most efficient combustion takes place when the vacuum is relatively small and the speed high. The higher vacua were never steady, but were obtained in a series of jerks. The conditions necessary for the most effective combustion require that the current of air supplied to the fire should be a steady current, and the amount sufficient to render the velocity of combustion great enough for the production of the necessary steam. The employment of the exhaust steam to induce the air supply is only efficient at high speeds, when the "puffs" follow in extremely rapid succession, so maintaining a steady partial vacuum in the smokebox, while the air is pushed in through the ashpan dampers and thence through the fire at a moderately high and fairly constant pressure, due to the passage of the engine through the air. When the thickness of the fire is considerable and the air supply is intermittent, as when the steam blast is employed and at low speeds, the tendency for the carbon-dioxide to be reduced to carbon-monoxide is greatly increased; hence *a priori* one would expect a much smaller loss of carbon, due to the formation of carbon-monoxide, in an engine with a thin fire than in one having a deep fire. This point was next investigated. The engine employed was a London & North Western Railway locomotive of the "Experiment" class. In this class of locomotive the firebox is only about one-half as deep as in the "Precursor" class, but considerably larger in other directions. With the "Experiment" the runs were nearly all on the Carlisle route, and include all the heaviest, long, non-stop runs on the London & North Western Railway system. The loads taken were, as a rule, very heavy and the average speeds high. Further, this class of engine was specially designed with a view to working heavy passenger traffic on the London to Carlisle route. With this engine it was found that the percentage of carbon monoxide was not as high as with the "Precursor" class. With the latter it rose to 4.2 and 3.8 per cent., while with the "Experiment" the highest value was 1.7 per cent. The partial vacuum in the smokebox is also much less in the "Experiment" class than in the "Precursor" class, due to the decreased thickness of the fire, which offered less resistance to the passage of the air and also to the increase in area of the grate. The vacuum in the smokebox in this class was about $^3/_5$ in. of water, higher figures only being occasionally reached.

The results show a very great diminution in the percentage of carbon-monoxide, even in the highest it is less than 2.0 per cent., while the carbon-dioxide, in the majority of instances, is high. The "gas producer" action of the firebox, resulting in the partial reduction of the carbon-dioxide to monoxide, is very greatly reduced, as the results show, by reducing the depths of the fire.

The rapid passage of the air through the thinner fire resulted in holes being made in the fire by the "jerky" steam blast, and consequently a large amount of air was drawn through which had no time to come into contact with the fuel, owing to the rapidity of its passage. The passage of so large an amount of excess air resulted in a considerable lowering of the temperature.

Other data show a similar increase in the amount of oxygen when the engine is working heavily. Comparing the results for the "Experiment" with those for the "Precursor" class, the advantage of employing a thinner fire is manifest, so far as efficient combustion is concerned. At the same time, it is evident that a greater amount of judgment in firing is required, in order to prevent the fire breaking into holes and unduly large excess of air being drawn through the fire, thereby reducing the temperature and seriously impairing the steam-raising power of the engine. The presence of the carbon-monoxide in the products of combustion, together with excess oxygen, may be due to either the cooling of the gases before the combustion was complete, or to incomplete mixing.

At the stage of the combustion when the samples were taken, that is, after the smoke had cleared, the amount of unburned hydrocarbons was nil, only very slight traces being

found in the samples. The loss of carbon as smoke was not excessive, as comparatively little smoke is emitted by a locomotive when running. The loss of solid fuel thrown out by the steam blast through the funnel is extremely difficult of estimation, but is considerable in amount. The heat carried off in the products of combustion is another source of loss of fuel, but one of the most difficult of remedy in a locomotive, where space is limited, and where increase of weight beyond certain limits is undesirable.

These results represent the combustion taking place in first-class locomotive practice and on express trains of high average speeds. The loss due to the formation and escape of carbon monoxide must necessarily be greater with low-speed trains, owing to the intermittent character of the air supply.

The employment of a suitable forced draught, by means of which the air supply would be under control, should do much to reduce the loss of solid fuel, thereby removing a source of danger and also doing away with the dependence of the air-supply upon the speed of the engine.

THE PLANT OF THE MILWAUKEE CAR MANUFACTURING CO.

The plant of the Milwaukee Car Manufacturing Co. is located on the Chicago, Milwaukee & St. Paul Railway, at Gibson Station, a manufacturing suburb of Milwaukee, Wis. The original plant, completed last November, had a normal output of four cars a day. Already it has become necessary to double this capacity, and work is now under way on the necessary enlargements.

The original plant had 30,410 sq. ft. of floor area and comprised a main building 82 ft. x 286 ft. divided by a fire wall into the erecting shop in one end and wood mill and machine shop at the other; blacksmith shop, 50 ft. x 61 ft.; power station, 44 ft. x 71 ft.; storeroom and office building, 32 ft. x 90 ft., and fan room and toilet rooms, 27 ft. x 29 ft. There is also an oil house and large material sheds.

The buildings are brick, except the oil house and material sheds, which are corrugated iron and wood, respectively. The main building has steel roof trusses, and the others iron girder roof supports. Asbestos fireproof roofing is used, and all floors, except in the blacksmith and erecting shops and the material sheds, are concrete. To give proper light and ventilation the side walls have large windows and the roofs ample skylights, the total glass area being over 15,000 sq. ft.

The plant is electric driven throughout, either by individual motor or group drive. The power house has an engine room 37 ft. x 44 ft., and boiler room 33 ft. x 44 ft. The latter has a 275-h.p. Stirling water-tube boiler, with provision for duplicating the unit. The stack is 125 ft. high and 66 in. inside diameter, and the furnace is designed to be smoke-consuming. It is equipped with shaking grates, and burns the refuse from the wood mill, which is fed to it automatically. The boiler feed water is drawn from a deep well and has considerable scale-forming solids. A feed-water heater and purifier removes the solids and raises the temperature of the water before injection into the boiler. The boiler feed pump is a single-cylinder, outside packed, double plunger type, which has a capacity of 40 gals. a minute, against a pressure of 150 lbs. per square inch. There is ample storage room for coal at the station, and provision for ready removal of ashes.

The engine room has a 300-h.p. Corliss single cylinder, non-condensing engine running at 120 r.p.m. It is direct-connected to a 220-volt a.c. three-phase generator, which supplies current for both power and light. The air compressors are steam driven, with a capacity of 105 cu. ft of air per minute at 110 lbs. pressure. There are two pumps, one for fire protection and sprinkling and the other to draw from the deep well above mentioned. The first of these has a capacity of 1,000 gals. per minute at 125 lbs. pressure. It is equipped with automatic pressure regulators and governors and is under steam at all times. The other is a steam-driven deep well pump, which delivers the water from the well to an elevated tank having a capacity of 500 gals., or to the cistern marked No. 1 on the plan.

Wood Mill.

The wood mill, a view of which is shown, includes the following equipment:

No. 95 planer and matcher (Berlin Machine Works,.
No. 14 timber sizer (Berlin Machine Works).
38-in. Clement band saw (American Wood-Working Machinery Co.).

Erecting Department; Milwaukee Car Manufacturing Co.

No. 306 four-spindle horizontal borer (Greenlee Bros. & Co.).
No. 6C heavy horizontal automatic hollow chisel mortiser and borer (Greenlee Bros. & Co.).
No. 4 automatic vertical car sill tenoner (Greenlee Bros & Co.).
No. 3 self-feeding rip saw (J. A. Fay & Egan Co.).
No. 3 swinging cut-off saw (J. A. Fay & Egan Co.).

No. 1 automatic knife grinder (J. A. Fay & Egan Co.).
No. 4 universal wood-worker (J. A. Fay & Egan Co.).
No. 334 cut-off and rip-saw (Niles-Bement-Pond Co.).
No. 92 medium swing saw (Niles-Bement-Pond Co.).
No. 73 double planer (Niles-Bement-Pond Co.).
No. 144 traversing gaining machine (Niles-Bement-Pond Co.).
No. 461 five-spindle vertical car boring machine (Niles-Bement-Pond Co.).

The mill is equipped with a shavings exhaust system installed by the National Blower Works, Milwaukee. It and the erecting and machine shops are heated by a hot blast system installed by the same company, having a capacity of 35,000 cu. ft. of air per minute. The system is used for ventilating and fresh air supply in hot weather. The other buildings are heated by steam coils.

The machine shop contains the following equipment:

2 21-in. upright drill presses.
No. 14 Harrington four-spindle drill press.
1½-in. Acme four-spindle nut tapper.
No. 4 Partridge double grinder.
1½-in. Acme double bolt cutter.
12 in. x 5 ft. Davis engine lathe.
42-in. car-wheel borer (Niles-Bement-Pond Co.).
No. 2 double-axle lathe (Niles-Bement-Pond Co.).
24-in. back-geared shaper (Niles-Bement-Pond Co.).
200-ton hydraulic wheel press (Niles-Bement-Pond Co.).
No. 7 Jarecki pipe machine.

The blacksmith shop uses crude oil for fuel in specially designed furnaces. It is pumped under pressure to the furnaces after having been warmed and filtered. The storage supply is contained in a steel reservoir of 12,000 gals. capacity. The list of tools in the smith shop includes:

Combined punch and shear (New Doty Mfg. Co.).
1,500-lb. steam hammer (Niles-Bement-Pond Co.).
200-lb. Bradley hammer (Niles-Bement-Pond Co.).
50-ton hydraulic riveter (Niles-Bement-Pond Co.).
No. 5 bulldozer (Niles-Bement-Pond Co.).
2-in. heading and forging machine (Niles-Bement-Pond Co.).
Fuel oil furnaces (National Supply Co.).

As previously mentioned, the tools in these different shops are motor driven. The motors range in size from 5 to 50 h.p. and were furnished by the Westinghouse Co. All shafting is carried by structural steel supports from the steel roof trusses, except such countershafting as was put on the floor. All tool and machinery foundations, with a few exceptions, are concrete.

The erecting shop, when enlarged, will have a daily capacity of eight cars. Material is moved by trolley air hoists and on the material tracks between the erecting tracks. The latter connect with the yard system of narrow-gage tracks for moving material between the material yards and all departments. Pneumatic boring and chipping tools are used in the erecting shop.

North Half of Smith Shop; Milwaukee Car Manufacturing Co.

The shops are out of reach of fire protection from the city and are equipped with their own system, centering in the Underwriters' pump in the power station. Heavy cast-iron mains radiate from this pump to fire plugs located in the buildings and material yards. The No. 1 underground cistern previously referred to has a capacity of 60,000 gals. Hose reels, ladders and other fire-fighting equipment are housed in a small outbuilding centrally located. In the buildings are inside standpipes with hose racks and hose. The plant also has its own sewer system, with large septic basins for disposal of the sewage.

The plant was designed and equipped by C. A. Chapman, Consulting Engineer, Chicago, who also supervised the construction. The Foster Construction Co., Milwaukee, was the contractor.

WORK OF THE RAIL COMMITTEE OF THE MAINTENANCE OF WAY ASSOCIATION.

The Rail Committee of the American Railway Engineering and Maintenance of Way Association has been organized with the following sub-committees:

(1) A committee on Experiments and Tests.
(2) A committee on Sections and Specifications.
(3) A committee on Rail Service.

The work assigned to these committees is as follows:

Committee No. 1—Experiments and Tests.

(a) Confer with the Manufacturers' Committee, through its chairman, F. W. Wood, from time to time, in order to keep each committee posted concerning the work of the other. It is of the greatest importance that we should lose none of the harmonious feeling which has been established by the American Railway Association between the railroad men and the manufacturers.

(b) Report on best design for drop testing machine, after conference with the Manufacturers' Committee.

(c) Report upon the results of drop tests.

(d) Recommend additional methods for testing rails.

(e) Exchange statistical information with the committee of the Manufacturers' Association, and under instructions from the General Committee, confer with kindred associations.

(f) Make such tests as may be deemed advisable by the General Committee, investigate and report upon tests made by outside parties, such as the Watertown Arsenal, when available, and examine and report upon methods of manufacture and the handling of rails at the mills.

Committee No. 2—Sections and Specifications.

(a) Recommend such changes as may be necessary in the Manual of Recommended Practice.

(b) Prepare and submit for approval a single type of rail section. It is not expected that this report can be completed until sufficient time has elapsed to complete service tests.

(c) Report upon the advisability of canting rails and the general relation of the wheel to the rail.

(d) The joint considered as a whole. Recommend design and specifications.

Committee No. 3—Rail Service.

(a) Submit blanks for tabulating rail statistics.

(b) Collect and compile rail statistics. In this connection, photographs and characteristic rail failures should be collected from all parts of the country.

(c) Report on rails now in use made of steel composed of different alloys.

(d) Make comparative statement of the results of the use of series A and B, and other sections of rail.

The following are the members of these sub-committees:

Committee No. 1—Experiments and Tests.—Charles S. Churchill, R. Montfort, P. H. Dudley, J. D. Isaacs, Thomas H. Johnson, J. P. Snow, F. A. Delano.

Committee No. 2—Sections and Specifications.—J. B. Berry,

George W. Kittredge, Jos. T. Richards, J. F. Hinckley, J. W. Kendrick, Robert Trimble.

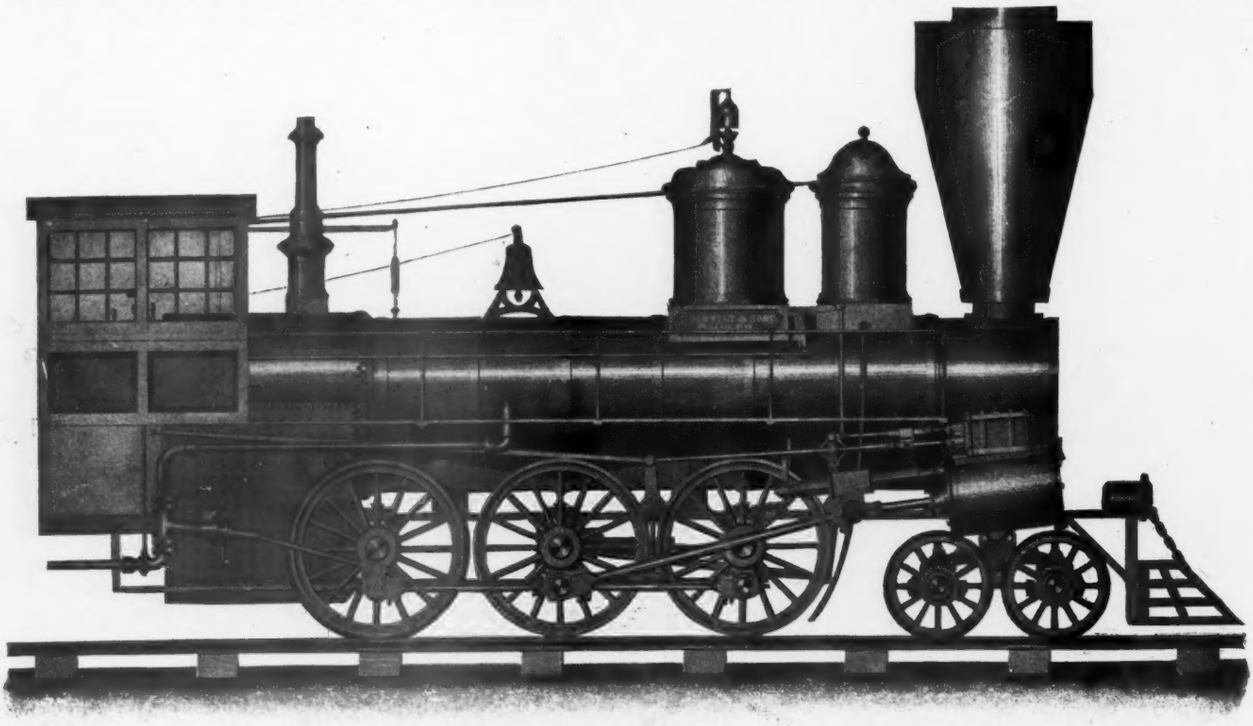
Committee No. 3—Rail Service.—W. C. Cushing, D. W. Lum, J. A. Atwood, A. S. Baldwin, Howard G. Kelley, C. H. Ewing, E. B. Ashby.

The next meeting of the General Committee will be held at Atlantic City, N. J., June 26 and 27.

DENMEAD TEN-WHEEL FREIGHT ENGINE.

BY J. SNOWDEN BELL.

The firm of A. W. Denmead & Sons, which went out of business about the close of the Civil War, used to be located on Monument street, at Jones' Falls, in the city of Baltimore, and built heavy machinery of various descriptions, including the engine of the United States double-ender "Monocacy" and other naval vessels. A number of locomotives, of the then largest class, were also built at the Denmead shops for the Baltimore & Ohio, the Virginia & Tennessee, and other southern railroads, a few of which were within the knowledge of the writer, but do not seem to have found a place in the "Development of the Locomotive Engine" or any other record of the history of locomotive building in the United States, beyond the mere mention of the name of the firm in Colburn's little book on locomotives, published about 1854.



Ten-Wheel Locomotive Built by A. W. Denmead & Sons.

An examination of the valuable historical data collected by the late M. N. Forney developed an old lithograph of a Denmead freight engine which was probably built some time in the late fifties, and seems of sufficient interest to merit reproduction, as illustrative of several of the features of the standard practice at that time which have now almost passed out of recollection. The writer has been at some pains to obtain information as to this and other Denmead engines, but no particulars appear to be available, and the lithograph gives no identification of the engine beyond that it was "No. 12" of the firm's build. Among the structural features which were then approved, but have long since been abandoned, may be noted the inclined cylinders above close set truck wheels; the drop hook motion for main valves and the independent cut off valves worked by separate eccentrics; the unequal armed springs between driving wheels, serving as equalizers; the half-stroke pumps worked by return cranks on rear axle, and the overhung firebox set between plate extensions of the frame rails. The lithograph appears to be on a scale of 1 in. to the foot, which would make the driving wheels 50 in. in diameter, the boiler about 46 in. at front ring, and the cylinders 22-in. stroke by about 17-in. diameter.

Denmead & Sons built 11 engines of the Hayes 10-wheel (4-6-0) type, with cab on top of boiler and inclined top firebox, for the Baltimore & Ohio in 1853 and 1854, these being Nos. 129, 138, 159, 165, 166, 167, 199, 202, 204, 205 and 209. In March, 1857, they built for the same road two small passenger engines of the 4-4-0 type with 15 x 20 cylinders, Nos. 220 and 221, and from April to December, 1857, built for the same road seven 10-wheel (4-6-0) engines with cylinders 19 x 22 and 50-in. driving wheels, these latter being on the design of Henry Tyson, then Master of Machinery, and being one of the results of an acrimonious contest between Mr. Tyson and Ross Winans as to the relative merits of the 10-wheel and camel types, in which Mr. Tyson, who advocated the former, was victorious. While, from a theoretical standpoint, he was probably correct, the seven Denmead 10-wheel engines, Nos. 222, 223, 224, 225, 226, 227 and 228, and two others of substantially the same design built under his direction at Mount Clare shops, Nos. 229 and 230 did not prove satisfactory in service, largely, if not wholly, by reason of the insufficient amount of weight on their trucks, which caused them to give a great deal of trouble by failing to keep the track. These engines had Gooch or "stationary" links, straight boilers of fairly large diameter, and, except as to the insufficiency of weight on the truck, were generally of good mechanical design under the standard practice at their date.

It is possible that further data as to the character and extent of the work of the Denmeads in locomotive building may be obtainable, and the foregoing may help in developing it.

The Japanese President of the South Manchurian Railroad is said to be negotiating with the Russian authorities for the purchase of that Russian part of the line, from its junction with the line to Vladivostok at Charbin southward 148 miles. It is even reported that Russia desires to sell the entire main line of the Chinese Eastern; which would indicate a purpose to depend on the Amoor line alone. Whether the Siberian Railroad would "pro-rate" with the Chinese Eastern in Japanese hands, while it had a through line of its own, seems more than doubtful; and whether the whole Chinese Eastern could live on the local traffic of Manchuria alone is far from certain.

SELF-CLEANING FRONT ENDS.

The report of the Committee on Locomotive Front-Ends to the Master Mechanics' convention of 1905 contained this statement: "Assuming that the first requirement is to obtain a self-cleaning front-end, it will require lengthy and practical experimenting to ascertain what design will afford the self-cleaning feature with the least obstruction to the passage of the front-end gases, and your committee feels that this subject will have to be determined by experimenting on engines in actual road service before any useful work in this connection can be done upon the testing plant." No committee experimenting of the kind suggested has ever been undertaken. And although an increasing number of motive power officers are coming to the conviction that the self-cleaning front-end is the right idea, there are still a good many who hold the contrary view. In order to learn in a general way what the situation is regarding this point, and for the collection of some statistics on front-end practice that do not seem to have been published heretofore, letters were sent to some thirty representative roads, nearly all of which answered. The information gathered has been tabulated, the nature of the questions being indicated by the column headings. It will be observed that out of the 26 roads listed, 12 use self-cleaning front-ends. Of the remaining 14, five have trouble from the hoppers leaking, with consequent burning of the smoke-box and door. One or two of the five reporting leakage say that it is not serious and does not require a great deal of attention to keep the front-ends in order. Eight roads reported no trouble from leakage.

Name of road.	Kind of fuel.	Cleaning hopper?	Trouble from leakage and b'rn'g?	Perforated plate or netting?	Size of mesh or perforation.	Size of wire.
Atch., Top. & S. F.	Semi-bit. Blk lig.	Yes.	Yes.	Netting.	2x2 3x3	No. 12 " 11
Canadian Pacific	Bitum.	No.	....	"	2½x2½	" 11
Central of N. J.	Anthra. Bitum.	Yes.	No.	"	1¾x3 3x3	" 10 " 12
Chesa. & Ohio	Bitum.	Yes.	No.	Both.	2½x2½ 5/16x1½	" 11 " 14*
Chicago & Alton	Bitum.	No.	....	Netting.	2½x2½	" 10
Chic. & N.-Western	Bitum.	No.	....	Plate.	5/16x1½	..
Chic., Burl. & Q.	Bitum. Lignite	Yes.	Yes.	Netting.	2½x2½ 4½x4½	No. 11 " 12
Chic., Mil. & St. P.	Bitum.	Yes.	Yes.	"	3x3	" 12
Del., Lack & Westn.	Anthra. Bitum.	Yes.	No.	"	2½x2½	" 10
Den. & Rio Grande	Bitum.	No.	....	"	2x2	" 10
Grand Trunk	Bitum.	No.	....	"	2½x2½	" 10
Great Northern	Bitum. Lignite.	No. Yes.	No.	"	2½x2½ 4½x4½	" 11 " 12
Illinois Central	Bitum.	Yes.	Yes.	"	2½x2½ 3½x3½	" 12 " 11
Lake Sh. & Mich So.	Bitum.	No.	....	Plate.	Tyler.	" 393
Louis. & Nash.	Bitum.	No.	....	Netting.	2¾x2¾	" 11
Mexican Central	Bitum.	No.	....	"	3x3	" 11
Missouri Pacific	Semi-An. Bitum.	Yes.	Yes.	"	3x3	" 12
Mobile & Ohio	Bitum.	Yes.	No.	"	2½x2½	" 11
N. Y. Central	Bitum.	No.	....	"	2½x2½	" 11
Northern Pacific	Bitum.	No.	....	"	.....	..
Pennsylvania	Bitum.	Yes.	Yes.	"	2½x2½	" 12
Rock Island	Bitum.	Yes.	No.	"	2½x2½	" 11
St. L. & San Fran.	Semi-An. Bitum.	Yes.	No.	"	3x3	" 11
Texas & Pacific	Bitum.	No.	....	"	.....	..
Union Pacific	Lignite. Bitum.	Yes.	No.	"	2½x2½	" 10
Wabash.	Bitum.	Yes.	No.	"	2½x2½	" 10

*Thickness of plate.

In addition to the points given in the table, the question was asked, "Do you consider a self-cleaning arrangement the most desirable? Kindly give your reasons for or against this." Below are extracts from a number of the replies, in some of which this point is covered.

Atchison, Topeka & Santa Fe.—While our experience indicates that a smoke-box hopper is useless, at least in certain localities and with particular grades of coal, we have in practically all cases cut the necessary hole in the smoke-box sheet. On some engines the hole is now closed with a blank flange, but on most all of them the hopper is kept in working order for occasional use when an especially bad consignment of coal is delivered to the engine. Some trouble has been experienced from leaky hoppers, and for this reason we prefer to eliminate them where quality of coal used will permit. A self-cleaning arrangement is preferred, because if properly designed, and used with the grade of coal for which designed, it does what the name implies. Under these conditions the necessity for shoveling cinders from the smoke-box is avoided and the cinder hopper can also be omitted.

Central Railroad of New Jersey.—We believe that a self-cleaning arrangement is preferable, but we have not yet found it.

Chicago & North-Western.—We have adopted the self-cleaning front-end because it cuts out the expense of maintenance of front-ends. The engines steam more uniformly, as they are not getting filled up in the front-end, and when the front-end cinders get on fire it interferes with the draft materially. The self-cleaning front-end eliminates all of this.

Chicago, Milwaukee & St. Paul.—We do use a hopper, which, like everything else on a locomotive, sometimes gets out of order and requires attention, but the attention which it requires to keep it in good order is not a serious proposition.

Delaware, Lackawanna & Western.—Our front-end arrangement includes a hopper. We fit it to the smoke-box iron to iron (no copper joint between), and have very little trouble with it leaking. To prevent burning, all parts of the smoke-box must be air-aight. We do not favor a self-cleaning arrangement in the smoke-box. By keeping cinders, etc., in the smoke-box, we run less risk of setting fire along the track.

Denver & Rio Grande.—We do not use cinder hoppers, having removed them from all engines on account of trouble from leaking and consequent burning out of smoke-boxes, and, a worse feature, in our opinion, the failure of engines for want of steam on account of loss of vacuum due to leakage. We consider a self-cleaning front-end desirable. The necessity for frequent opening of front-end for cleaning, and the liability of destroying draft by leaky hopper, is avoided, providing the engine can be adjusted so it is really self-cleaning. The trouble with self-cleaning front-ends is principally with the adjustment. If they do not "self-clean" they must be frequently opened up and shoveled out, requiring the constant sealing of front-end door, etc.

Illinois Central.—We consider a self-cleaning arrangement the most desirable. Experience has shown that large power which is not self-cleaning will not steam.

Missouri Pacific.—As the front-end arrangement for locomotives was originally designed for a spark arrester, we do not consider the self-cleaning arrangement desirable. Of course, after the cinders have accumulated to a certain extent in the front-end, additional ones will be thrown from the stack, but these, in contact with those in the front-end, are more readily extinguished.

Mobile & Ohio.—We do not consider a self-cleaning arrangement entirely satisfactory, therefore use hoppers on our engines. The cinders are sometimes damp and fall to the bottom of the smoke-arch, causing an accumulation; to conform to the law we use fine netting through which many of the cinders will not pass, i.e., those large enough to cause trouble.

Pennsylvania Railroad.—We are inclined to think that not all coals behave alike in igniting in the front-end, but sparks from our coals seem to be very liable to this ignition. The fuel used is practically all bituminous coal, the exceptions in the way of anthracite coal and coke being a very small proportion of the total. The bituminous coals run all the way from gas coal having an approximate analysis of 56 per cent. fixed carbon, 37 per cent. volatile matter, and the remainder sulphur, ash and moisture, to the extremely low volatile coals having an approximate analysis of 77 per cent. carbon, 16 per cent. volatile matter, and the remainder ash, sulphur and moisture. We do not change our front-end arrangements to suit the different grades of coal.

As for the self-cleaning front-end, we think that all indications are in favor of the use of same. While it is true that cinders thrown out fill up the interstices in the ballast, preventing drainage and resulting in pumping track, it is very evident that we cannot hold in a smoke-box of workable size all the sparks that are drawn through the tubes, consequently we have to eject a very large number of sparks at any rate, and our condition would therefore not be much worse. However, these self-cleaning front-ends do involve, also, some means by which the sparks shall be broken up into small sizes before being ejected, in order to diminish the danger from fire.

In this connection, our French (DeGlehn) locomotive has a front-end which according to our standards is very insecurely fastened, consisting of a pressed steel door fitting on an inner

ring, the door being considerably cupped and having an inside lining. From the left-hand injector, on the delivery side, is taken a small pipe leading forward and terminating in a horizontal pipe in the upper part of the smoke-box, which pipe is perforated from end to end; the arrangement is such that the act of throwing on the left-hand injector wets down the sparks. This arrangement works very well in wetting down the sparks. Of course, the wet sparks have to be cleaned out by shoveling, as they will not drop through a hole by simply opening a slide at the bottom of the smoke-box.

Rock Island Lines.—Our front-end is only partially self-cleaning, and possibly this arrangement is best in a dry country.

Texas & Pacific.—We are operating through a cotton country and have experienced no trouble with the self-cleaning front-ends.

Union Pacific.—The locomotives on the Union Pacific are self-cleaning. This reduces the work of the engine crews and reduces time lost through delays.

AN EARLY AND THOROUGH TEST OF CONTINUOUS BRAKES IN ENGLAND.

BY C. H. CARUTHERS.

The success attending the general introduction of the Westinghouse air-brake on the railroads of America not only attracted the interest of English railroad officials, but also awakened them to the urgent necessity of improving the can brethren; and when he does take a subject in hand, it is with a degree of thoroughness which effectually reveals every merit and every demerit, and settles forever the adoption or rejection of the whole matter. Hence when continuous brakes, as they are generally called in England, loomed up as a necessity in the railroad practice of the country, English railroad men generally admitted the fact and only hesitated as to which of the various types already designed might be best adapted to their requirements. Having gone thus far, what might be termed a competitive test was decided upon; and this test, of which a condensed description follows, was unquestionably one of the most thorough which has ever been accorded to any device employed in railroad practice.

This test, or rather this series of tests, covered a period of several days between June 9, and June 16, 1875, on the Nottingham & Newark division of the Midland Railway; and was conducted both under the auspices of the Railway Companies' Association, and under the direction of the Royal Commission on Railway Accidents. A portion of the "up" line about four miles long, lying between Rolleston Junction and Thurgaton, was especially set apart for the purpose and the regular traffic between the towns named was worked during the time under single-track rules with the use of a pilot engine on the down line in both directions.

All trains were handled on both lines under the direct control of Mr. Loveday, an official of the Midland Railway, and the very efficient manner in which he performed his duties contributed largely to the successful carrying out of the ar-

Engines.	Caledonian.	Great Northern.	Lancashire & Yorkshire.	London Brighton & South Coast.	London & North Western.	Midland.			North-Eastern.
Cylinders, diameter	17½ in.	17 in.	15 in.	17 in.	17 in.	17 in.	17 in.	17 in.	17 in.
Cylinders, stroke	24 in.	24 in.	22 in.	24 in.	24 in.	24 in.	24 in.	24 in.	24 in.
Number of leading wheels	2	2	2	2	2	2	2	2	2
Diameter of leading wheels	44 in.	48 in.	.....	.....	42 in.	50 in.	50 in.	50 in.	54 in.
Number of driving wheels	4	2	4	2	4	4	4	4	4
Diameter of driving wheels	86 in.	84 in.	69 in.	81 in.	78 in.	80 in.	80 in.	80 in.	84 in.
Number of trailing wheels	.....	2	.....	2	.....	.....	.....	.....	.....
Diameter of trailing wheels	.....	48 in.	.....	.....	.....	.....	.....	.....	.....
Wt. on leading wheels	24,500 lbs.	21,840 lbs.	19,992 lbs.	25,172 lbs.	22,120 lbs.	26,348 lbs.	24,724 lbs.	26,152 lbs.	26,656 lbs.
" driving (single) whls.	.....	33,656 lbs.	.....	35,504 lbs.	.....	.....	.....	.....	.....
" driving (coupl'd) whls.	55,692 lbs.	.....	42,476 lbs.	.....	53,844 lbs.	59,500 lbs.	57,316 lbs.	59,472 lbs.	60,872 lbs.
" trailing wheels	.....	17,416 lbs.	.....	20,132 lbs.	.....	.....	.....	.....	.....
Total weight of engine	80,192 lbs.	72,912 "	62,468 "	80.808 lbs.	75,964 lbs.	85,848 lbs.	82,040 lbs.	85,624 lbs.	87,528 lbs.
Type of train brake	Steel and McInnes.	Smith vacuum.	Fay.	Westinghouse vac.	Clark & Webb.	Hydraulic— Barker.	Clark.	Westinghouse auto.	Smith vacuum.
Wheels fitted with brakes	None.	None.	None.	Drivers and trailing.	None.	Drivers.	Drivers.	Drivers.	Drivers.
Blocks, material	.....	.....	.....	Wood.	.....	Cast-iron.	Wood.	Cast-iron.	Wood.
" No. to each wheel	.....	.....	.....	1	.....	2	1	1	1
" how applied.	.....	.....	.....	Steam or hand.	.....	Hydraulic or hand.	Hydraulic or hand.	West. auto. or hand.	Smith vacuum.
Tenders. *(All 6-wheeled and one wooden block to each wheel.)*									
Weight	59,612 lbs.	66,024 lbs.	49,000 lbs.	63,168 lbs.	51,212 lbs.	53,536 lbs.	58,688 lbs.	53,984 lbs.	61,936 lbs.
Diameter of wheels	44 in.	48 in.	.....	.....	42 in.	49½ in.	49½ in.	49½ in.	.....
How brake is applied	Hand or Straight air.	Hand.	Hand.	Hand.	Hand.	Hydraulic or hand.	Hydraulic or hand.	West. auto. or hand.	Vacuum or hand.
Trains. *(Two vans and 13 carriages in each.)*									
Weight of train	302,288 lbs.	438,144 lbs.	306,628 lbs.	313.320 lbs.	413,700 lbs.	331,240 lbs.	303,240 lbs.	315,560 lbs.	.....
Approximate weight on wheels fitted with brakes	302,288 lbs.	438,144 lbs.	306,628 lbs.	313,320 lbs.	275,800 lbs.	331,240 lbs.	202,160 lbs.	315,560 lbs.	.....
Number of wheels with brakes	60	86	60	60	60	60	40	60	.....
Number of blocks to a wheel	1	1	1	1	2	56—2 bl. 4—1 bl.	32—2 bl. 8—1 bl.	56—2 bl. 4—1 bl.	.....
Material of blocks	28 wood, 32 cst-irn.	16 wood, 70 cst-irn.	Wood.	Cast-iron.	Cast-iron.	56 cast-iron 4 wood.	32 cast-iron 8 wood.	Cast-iron.	.....
Entire number of wheels	60	86	60	60	90	60	60	60	.....
Approximate weight on wheels fitted with brakes*	361,900 lbs.	504,168 lbs.	355,628 lbs.	432,124 lbs.	279,692 lbs.	444,276 lbs.	317,604 lbs.	429,016 lbs.	.....
Per cent. of weight on braked wheels	81.8	95.5	85.0	94.5	51.7	94.4	71.5	94.3	.....
Condensed data of test									
Distance run in best stop	1,132 ft.	1,448 ft.†	1,400 ft.†	1,728 ft.	1,096 ft.	1,116 ft.	1,070 ft.	840 ft.	.....
Time consumed in stopping	24 secs.	29 secs.†	28 secs.†	34½ secs.	24¾ secs.	25 secs.	21 secs.	18 secs.	.....
Speed per hour at application	49½ mls.	49½ mls.†	57½ mls.†	52 mls.	50¾ mls.	49½ mls.	54½ mls.	52 mls.	.....
Condition of rail	Dry.	Dry.	Dry.	Wet.	Dry.	Dry.	Dry.	Dry.	.....
Equiv. distance at 50 m.p.h.	1,158 ft.	1,477 ft.†	1,007 ft.†	1,591 ft.	1,064 ft.	1,139 ft.	901 ft.	777 ft.	.....
Distance run in poorest stop	1,603 ft.	1,088 ft.	1,165 ft.	2,200 ft.	1,337 ft.	1,628 ft.	1,429 ft.	1,082 ft.	.....
Time consumed in stopping	34½ secs.	23¾ secs.	27½ secs.	46½ secs.	29 secs.	34 secs.	27 secs.	22 secs.	.....
Speed per hour at application	49½ mls.	42¾ mls.	44½ mls.	54½ mls.	47½ mls.	49½ mls.	50¾ mls.	48½ mls.	.....
Condition of rail	Wet.	Dry.	Wet.	Dry.	Dry.	Dry.	Dry.	Dry.	.....
Equiv. distance at 50 m.p.h.	1,636 ft.	1,488 ft.	1,471 ft.	1,852 ft.	1,481 ft.	1,661 ft.	1,387 ft.	1,150 ft.	.....
Number of test trips	7	9	7	5	7	3	5	8	3

*Including engine, tender and train.
†Drawn by North Eastern engine.

dangerously inefficient braking devices then in use on most of the British lines.

An Englishman may be conservative, but his conservatism has always impressed the writer as of a type which in the end is productive of greater benefit to his fellow-men than often results from the more impetuous methods of his American brethren.

The portion of the line so set apart, which was devoted to the crucial part of the trials, was somewhat over 2⅝ miles in length, practically straight with very favorable grades; and this was again divided into two sections, one of six, and one of 40 subdivisions, each of which was marked by a series of

posts. Seven of these posts, located at the side of the track along the first section, were lettered in Roman numerals, O, IV, VIII, XII, XVI, XX and XXIV, and were spaced at a uniform distance from each other of 800 ft., each numeral representing four units of 200 ft. Post XXIV was also the O of the second section. The posts of this section were spaced at a uniform distance of 200 ft. from each other and were numbered consecutively in Arabic numerals, from 1 to 40 inclusive.

The posts of the first section enabled the observers to accurately obtain the speed attained by the trains before and at the time of application of the brakes. Two methods of ascertaining this were used. The first was by means of men stationed on the trains with stop watches, and the second was man recorded these times in seconds in a series corresponding to the time elapsing after passing post "O." At post "XX" the first man started another chronoscope beating quarter seconds, and stopped it on passing post "XXIV." Thus two independent observations noted the time consumed in running the last 800 ft. preceding the application of the brakes, and the records of the trips showed that in but few instances was a difference of even one-quarter of a second observed.

When the application of the brakes was made the first observer then signaled as before, and the second read off the time which was immediately entered on another record by the third, while a fourth man started a stop watch which he afterward stopped at the instant of perfect cessation of motion.

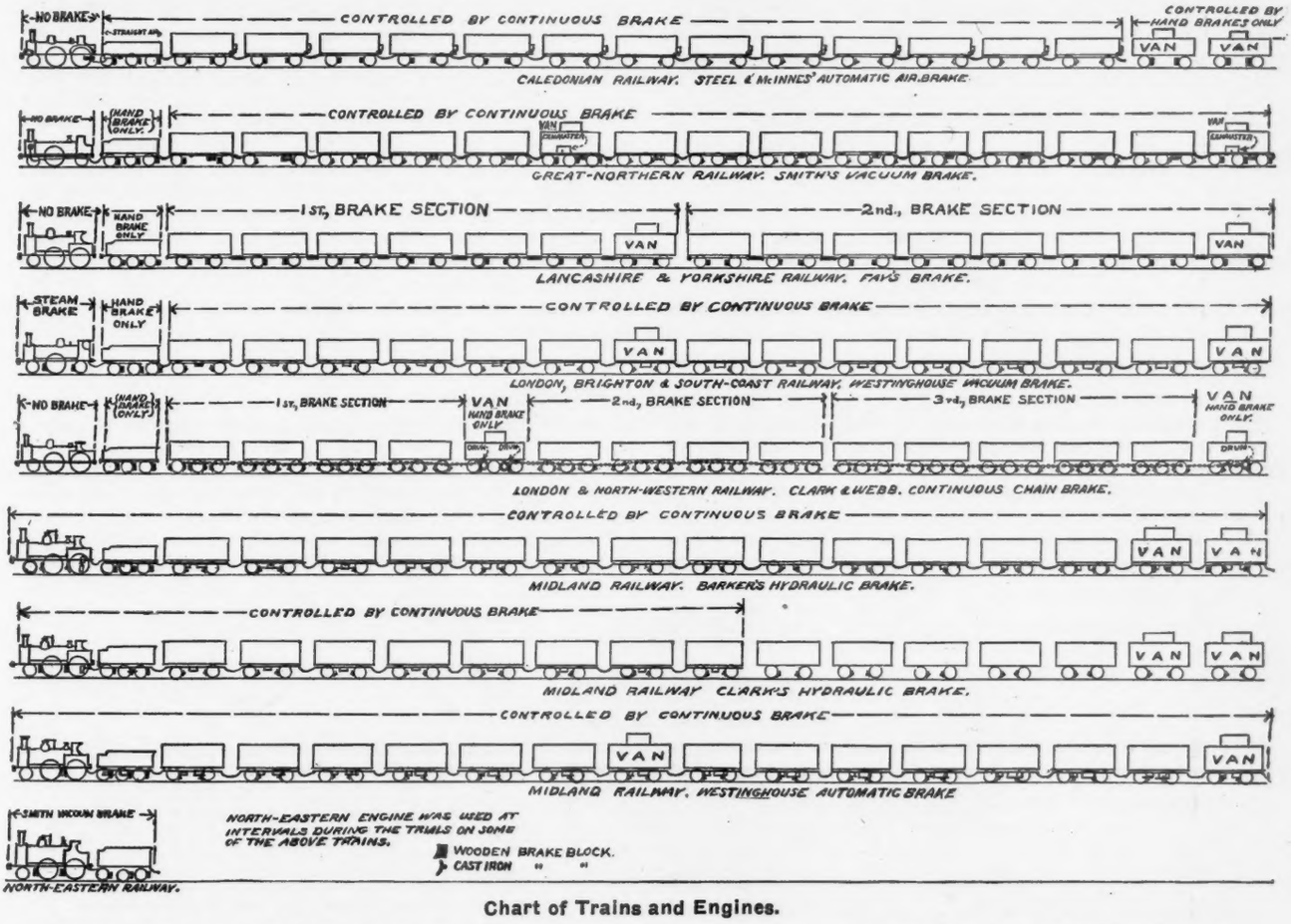
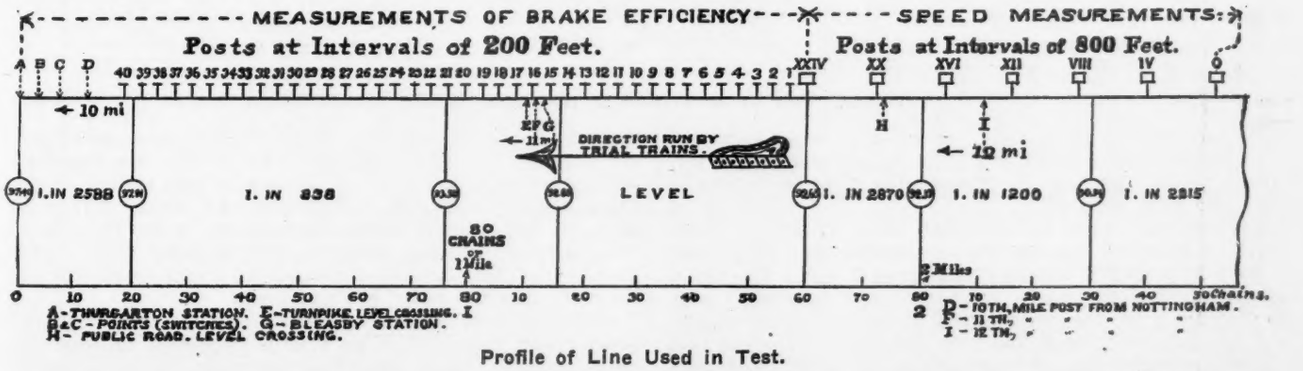


Chart of Trains and Engines.



Profile of Line Used in Test.

by members of a detachment of Royal Engineers stationed along the line at the posts, and also furnished with stop watches.

The observers in each train were four in number. One announced the passing of post "O" on the first section, and of each successive post to "XXIV." A second man, immediately after post "O" was called, started a stop watch, or chronoscope marking quarter seconds; and at each announcement of a post called out the time at which it was passed. A third

Meanwhile the men stationed at the side of the line registered the time of the trains as they passed these posts, and verified the records by a comparison of their watches later on.

The work of both sets of observers was supplemented by a simple and ingenious device at the side of the line, operated electrically. Two steel points pressed upon a strip of prepared paper driven by clockwork, and when an electric current passed through either point it left an impress on the

paper. One point was arranged to make an impress every half second, thus leaving a series of marks of that denomination on the paper.

The second point was connected by wires to contact levers, located in such a position between the rails of the line over which the trains were run, as to be depressed whenever the flange of the leading wheels of the engine passed over them, thus completing a circuit and causing this point also to make a mark on the paper. Subsequent comparison of these two series of marks furnished an easy method of calculating the exact speed of the trains. This device worked perfectly during all the days of the trials except one in which it was temporarily put out of commission by a passing thunder shower.

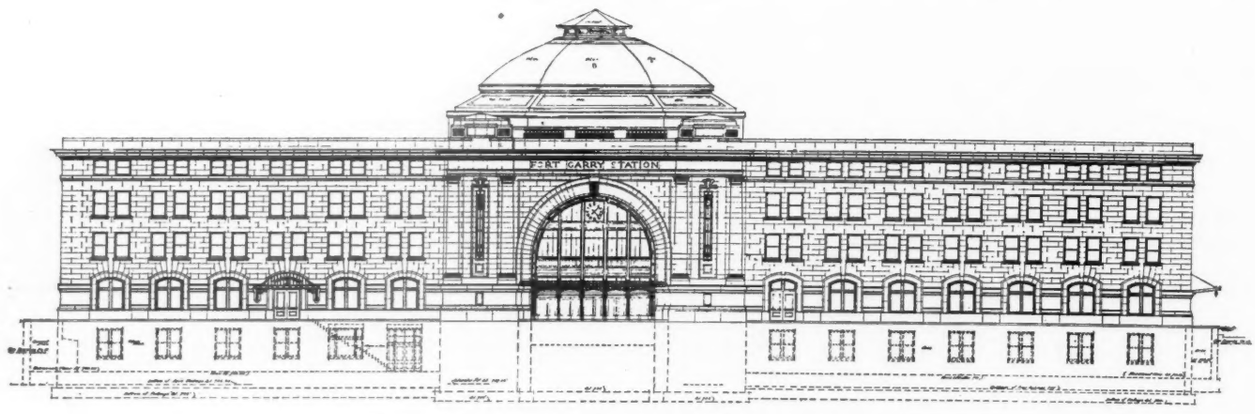
Six railroads furnished eight engines with trains for the occasion, and an engine from a seventh road was also used on one of the trips. Each of these trains consisted of 13 carriages and two vans, and the accompanying table, condensed from a much more minute one published at the time, will give a fair idea of their general "make-up." Eight different types of brakes were represented in the equipment, two of which were automatic air, two vacuum air, two mechanical, and two hydraulic.

(To be continued.)

UNION STATION AT WINNIPEG, MAN.

[WITH AN INSET.]

A contract has been awarded to Peter Lyall & Son, Montreal, to build a union station at Winnipeg for the joint use of the Canadian Northern and Grand Trunk Pacific. The contract price is stated to be $886,000, exclusive of the furnishings, the work to be completed by Oct. 1, 1909. The site, comprising some 70 acres of ground, is near the center of the city, and is bounded by Water street on the north, Main street on the west, the Assiniboine river on the south, and the Red river on the east. The main passenger building is to be built of stone, with a frontage of 350 ft., and a depth of 140 ft. The height of the main portion of the building will be in the first instance three stories and a basement. The original plans provided for four stories, so arranged to be increased to nine should occasion require. The central hall will be surmounted by a large dome 100 ft. above the street level, directly above the main entrance.



Proposed New Union Station at Winnipeg, Man.

This entrance leads to the ticket lobby, forming a circle 90 ft. in diameter, clear of columns and booths, and is well lighted from arched windows, one on each side. The ticket booths are located on the south side and passengers may go directly to the baggage counters in the rear of the booths, and from there through the rear vestibule to the subways under the tracks, and by stairways to the train sheds overhead. Telephone and newspaper booths will be placed on the north side of the ticket lobby. Adjoining the waiting room, on the west side and facing on Main street, a lunch room, area 1,300 sq. ft., and a restaurant, 2,200 sq. ft., are provided, each having separate entrances from the street. On the east side of the waiting room are placed a men's waiting room and a women's waiting room, each 1,800 sq. ft., while north of the waiting room there is an exit on a private street 50 ft. wide for carriages. The interior decorations of the waiting room will be of stone, the floors of terrazzo, and the walls paneled with the arms of each of the provinces of the Dominion. The south wing of the main floor, having an area of 8,000 sq. ft., will be given over to the accommodation of baggage. When more accommodation is required for baggage and express, the space beneath the tracks and platforms adjoining the rear of the building will be used, the room vacated being utilized for extra waiting rooms. The driveway for baggage and express at the south end of the building will be 3 ft. 6 in. below the level of the main floor, reached by a 5 per cent. down grade from Main street. Baggage will be handled by trucks through separate subways beneath the platforms and raised by electric elevators.

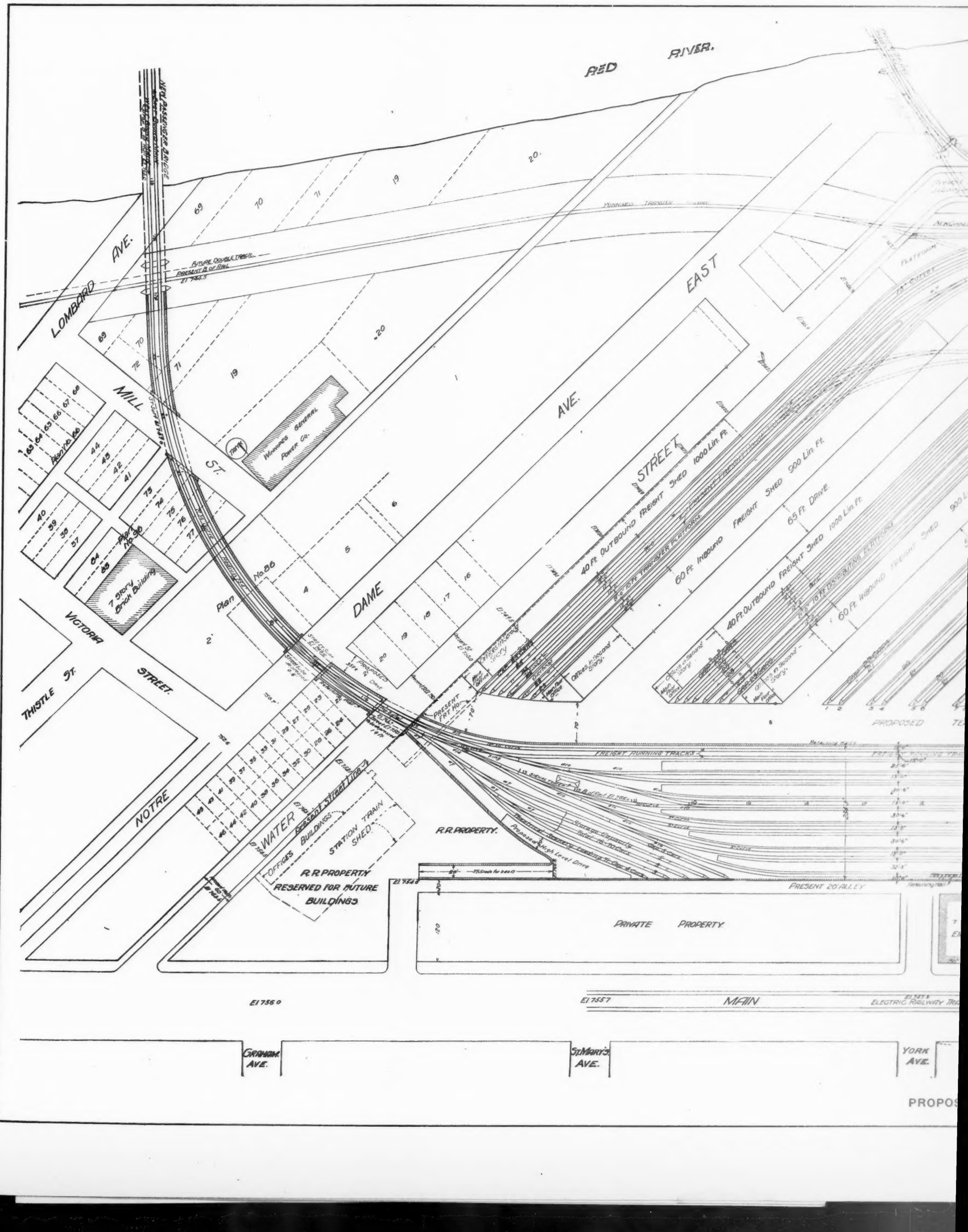
The basement is 15 ft. below street level. The south wing will be devoted to immigrants. The waiting room, with an area of 10,000 sq. ft., is provided with a lunch counter on the north side, and a laundry and bath rooms on the east. On the south side there will be a men's smoking room and women's room each with an area of 3,000 sq. ft. Separate entrances will be provided from Main street for immigrants. A barber shop is provided for, area 1,300 sq. ft., with entrances from Main street and the vestibule. The remainder of the west wing will be occupied by the kitchen, area 6,000 sq. ft., of the restaurant and lunch rooms overhead. The central portion of the basement will be used as a store room for sleeping and dining car supplies.

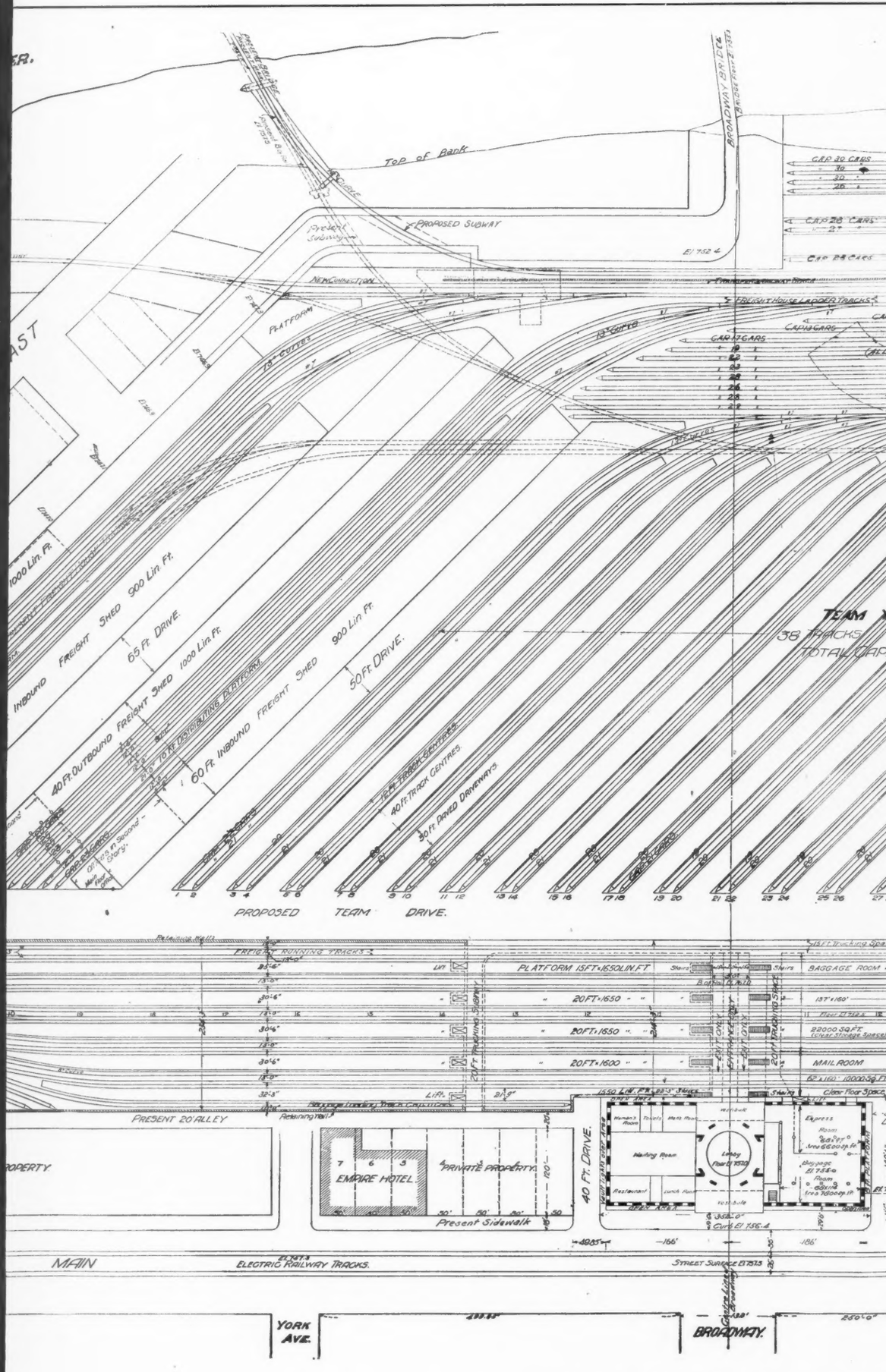
The upper floors will be occupied by the local and general western offices of the Canadian Northern, the Grand Trunk Pacific and the National Transcontinental, each floor having an available office space of 25,000 sq. ft.

The building will be of the steel structure type, contract for which has been sublet to the Dominion Bridge Co., Montreal, Que. The column loads will be supported at the foundations by concrete piles, contract for which has been awarded to the Raymond Concrete Pile Co., Montreal, Que. Each pile will be capable of sustaining a load of 35 tons.

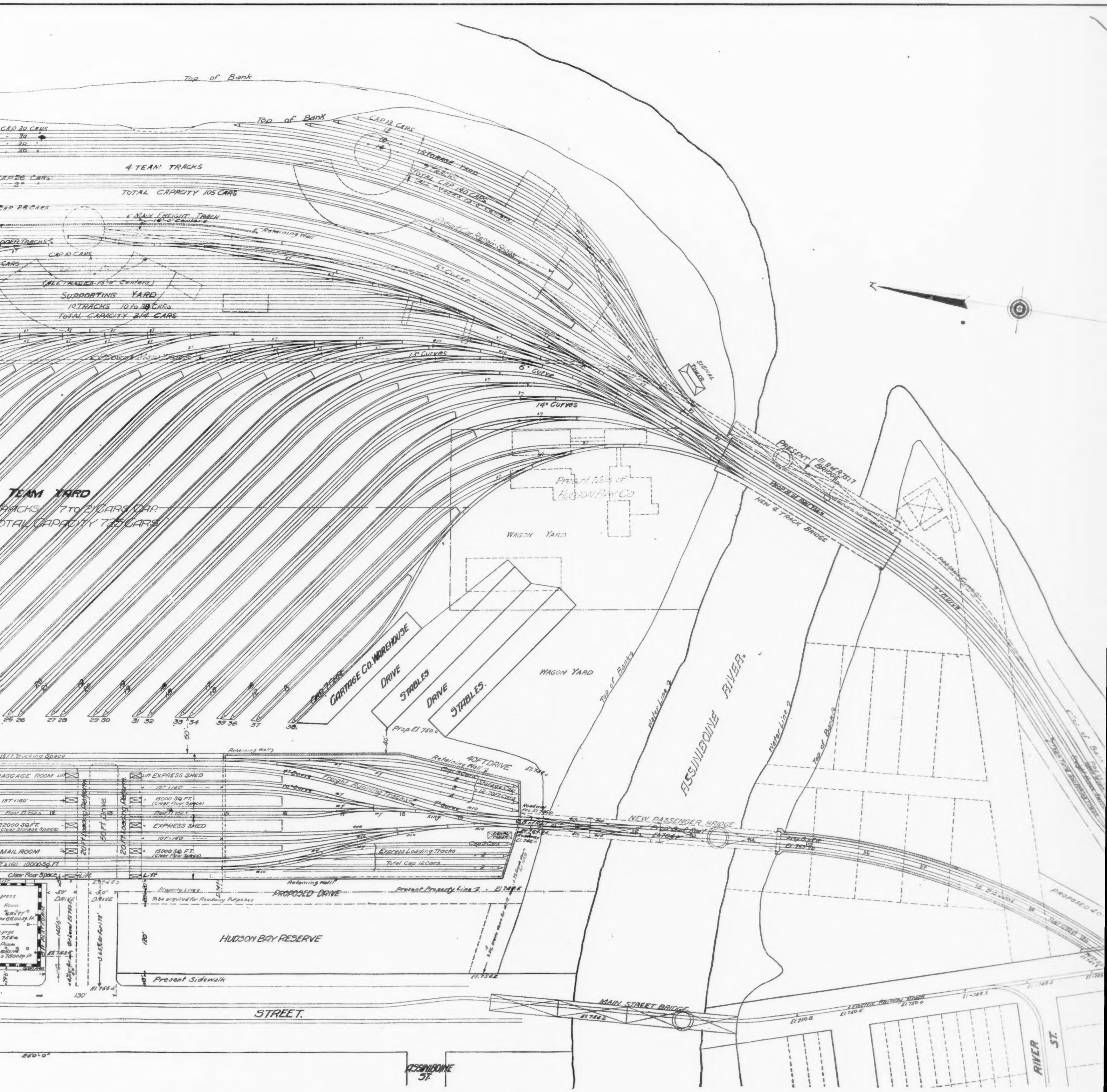
The track layout has been arranged for a through station, with tracks elevated over the intersecting streets, and above the main floor of the station. Eight through passenger tracks are provided for, with platforms. At the rear are two separate open running tracks for through freight trains. Each track will be capable of dealing with two trains of 11 cars each, the full capacity of the platforms to be 200 70-ft. cars. The reinforced concrete platforms will be raised 12 in. above base of rail, and between each pair of tracks there will be lines of pipes for water, gas and steam.

In future there will be located beneath the train shed express sheds, each having an area of 15,000 sq. ft., one for each company, will be located on the south side of the driveway, and on the north side will be a baggage room, area 20,000 sq. ft., and mail room, area 10,000 sq. ft. The system of handling baggage and express is nearly the same as that at Chicago, Washington, D. C., and Pittsburgh. The approach from the west will start about 20,000 ft. west from Main street and ascend at a maximum ruling grade of 0.4 per cent., passing over Main street on a double-track plate girder bridge, allowing an under clearance of 14 ft. The Assiniboine


RED RIVER.
EAST AVE.
LOMBARD AVE.
MILL
57.
DAME
STREET
VICTORIA
THISTLE ST.
NOTRE
STREET
WATER
STREET
Winnipeg General Power Co.
Plan No. 86
Plan No. 30
7 Story Brick Building
Present C.P.R. Line
Future Double Track
Present R. of Rail
El. 742.5
Winnipeg Transfer
Present C.P.R. Line
Proposed Street Line
Offices
Buildings
Station Train Shed
R.R. Property
R.R. Property Reserved for Future Buildings
Present 20' Alley
Private Property
Freight Running Tracks
40 Ft. Outbound Freight
60 Ft. Inbound Freight
40 Ft. Outbound Freight Shed 1000 Lin. Ft.
65 Ft. Drive
60 Ft. Inbound Freight Shed
Proposed
Main
Graham Ave.
St. Mary's Ave.
York Ave.
El. 756.0
El. 755.7

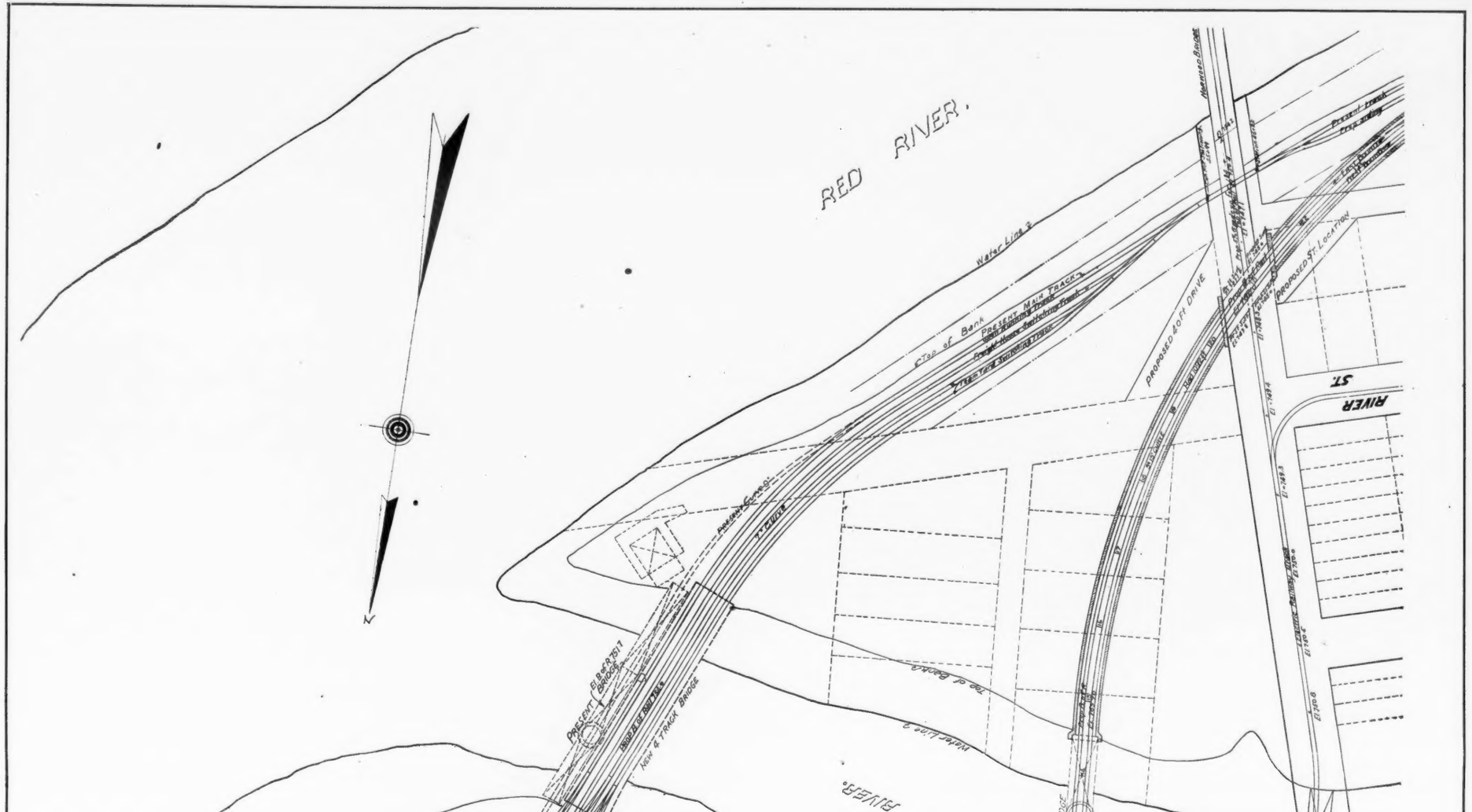


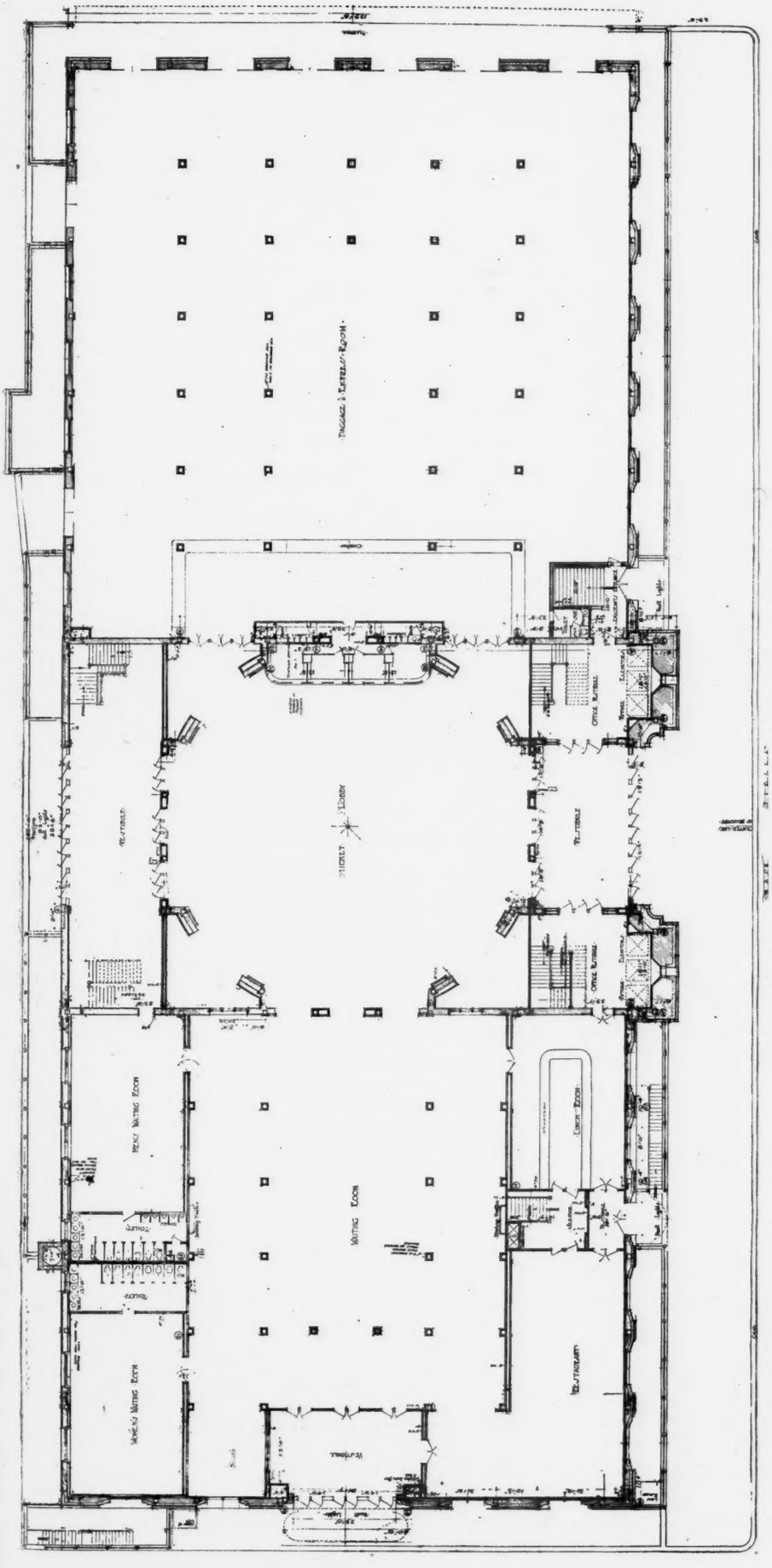
PROPOSED LAYOUT OF THE FREIGHT AND PASSENGER TRACKS O



RACKS OF THE NEW UNION STATION AT WINNIPEG, MAN.

F THE NEW UNION STATION AT WINNIPEG, MAN.


RED RIVER.
Water Line
Top of Bank
PRESENT M.H. TRACK
PROPOSED 40 FT DRIVE
PROPOSED ST. LOCATION
RIVER ST
PRESENT C.P.R. BRIDGE
NEW 4 TRACK BRIDGE
Water Line
RIVER



Plan of Main Floor of New Union Station at Winnipeg, Man.

river will then be crossed on a double-track steel truss bridge 400 ft. long, one span being a swing to allow the passage of vessels. The east approach will commence near St. Boniface station, rising with a maximum ruling grade of 0.4 per cent. to the Red river, crossing on a double-track steel truss bridge, 900 ft. long, having one draw span. Steel plate girder bridges will then carry the track over the Winnipeg Transfer Railway, Mill street, Notre Dame avenue and Water street, each bridge having an under clearance of 14 ft. Signal towers will be built at each end of the passenger layout. The electro-pneumatic interlocking signal system will be used.

The team yards will contain 42 tracks, having a total capacity of 830 40-ft. freight cars. The switching leads are to be divided into three separate divisions, of 13 tracks each, thus allowing three switching locomotives to work at the same time. The driveways will be 30 ft. wide between curbs, the tracks being 40 ft. centers across driveways.

There will be two sets of inbound and outbound sheds, the outbound being 40 ft. by 1,000 ft., each served by four tracks, and the inbound 60 ft. by 900 ft., each served by two tracks, and between these inbound and outbound tracks will be uncovered platforms 10 ft. wide.

The freight sheds will each be one story high, with steel columns and roof trusses. The freight offices, with 15,000 sq. ft. of office space, will be at the ends of the freight sheds in the second story. A bridge containing the freight agent's office will span the six tracks at the level of the office floors, and connect the inbound and outbound sheds. The supporting yard will have a capacity of 385 cars, and will be used for the reception and storage of arriving trains of loaded cars to be switched, and for departing empty cars. Connection will be made with the Winnipeg Transfer Railway track, over which cars for transfer with the Canadian Pacific will be handled. It is estimated that this will be the largest local freight delivery yard in existence.

The existing steel truss bridge across the Red river will be maintained and used mostly by Grand Trunk Pacific trains for running local freight between the terminal and the present general freight yard of the Grand Trunk Pacific, about three miles east. The present wooden drawbridge over the Assiniboine river will be replaced by a steel, four-track roller lift bridge, having two separately operated leaves. The only traffic across Main street will be trains of local freight passing between

the terminal and the Canadian Northern's general freight sheds, one mile west. A signal tower will be located on the north end of the new bridge over the Assiniboine river, from which all signals, switches and crossovers of the tracks entering the bridge will be controlled.

The sharpest curves in the layout are 14 deg., radius 410 ft., with No. 7 frogs and No. 10 for main track connections and main crossovers. The track in the freight yards will have 60-lb. rails and gravel ballast.

Two brick two-story stable buildings, each with accommodation for 200 horses, are planned. There are to be separate sets of locomotive sheds and shops for each of the two companies. The Canadian Northern shops have already been built about one mile west of the new station, near the road's present freight yards. The shops of the Grand Trunk Pacific, at its freight yard three miles east, are now in course of erection.

Warren & Wetmore, Architects, of New York City, have made all the designs of both passenger station and track layout; they will also supervise the work of construction. A. R. Whaley, Manager, Grand Central Station, N. Y. Central & H. R. R. R., was consulted by the architects in regard to the practical operating features of the track layout. Advice and assistance was rendered the preparation of the plans by W. Mackenzie, President; D. D. Mann, Vice-President; M. H. McLeod, General Manager and Chief Engineer, Canadian Northern. C. M. Hays, President; F. W. Morse, Vice-President, and B. B. Kelliher, Chief Engineer, Grand Trunk Pacific. J. D. Matheson was Assistant Engineer, in charge of the engineering work for the track layout. The new union station will be named Fort Garry, after an old fort of that name, which was erected as a Hudson's Bay Co. protection early in the nineteenth century.

THE COST OF LOCOMOTIVE REPAIRS ON THE ATCHISON, TOPEKA & SANTA FE.

Comparisons between costs of locomotive repairs on different railroads are valuable only as they reflect the general tendencies from year to year rather than the existing differences in cost.

The cost of locomotive repairs is influenced by a number of factors, namely: (1) Size of locomotive, (2) cost of labor, (3) cost of material, (4) operating conditions, (5) shop methods and facilities. All of these factors bear an intimate relation to locomotive repair costs and each must be considered when making cost comparisons either from year to year on the same road or between reports of separate companies.

A close investigation of conditions is always necessary before accepting cost figures as statements of real facts, or as a mirror reflecting the true elements that contribute to the results shown. This is especially true when comparing costs of locomotive repairs on the Santa Fe for the past few years as the figures given in no way indicate the higher efficiency maintained in locomotive repairs as compared with five years ago.

The annual reports of the road for recent years give the cost of locomotive repairs in cents per engine mile as follows: 1903, 8.67 cents; 1904, 11.34; 1905, 12.56; 1906, 9.54; 1907, 9.40. It will be observed that the cost of repairs was .73 cents per engine-mile higher in 1907 than in 1903. This is an increase of 8.4 per cent. Considering simply the cost of repairs, this represents a considerable increase in expense which might appear as retrogressive but an investigation of conditions gives an entirely different aspect to this result.

In the five year period ending 1907, locomotives on the Santa Fe have increased in number from 1,309 to 1,791, a total of 482, or 37 per cent. Among the principal types of locomotives, included in this number, there may be mentioned:

85	Santa Fe type	117	tons on drivers.
56	Prairie type.....	87	" " "
67	Pacific type	75	" " "
102	Atlantic type	50	" " "
Total 310		Average 82	tons on drivers.

In 1903 the average weight of locomotives on drivers was 46 tons. Considering only the heavy power noted above it will be observed that 310 locomotives having an average weight of 82 tons on drivers were added to the equipment in five years. This number is equal to 25 per cent. of the total number owned in 1903, and is made up of locomotives having a 78 per cent. greater average weight on drivers than the average locomotive of 1903.

The records of repair costs of individual locomotives for the past few years show that this item is proportional to the weight of locomotives, other conditions being equal or constant. On this basis, the repairs for the 310 locomotives designated, at the prevailing cost in 1903 of 8.67 cents per engine-mile, would amount to 15.43 cents per engine-mile; or if these 310 locomotives were added to the equipment in 1903, the total number of locomotives would have been increased 25 per cent., with a total average repair cost of 10.38 cents per engine-mile. The rate in 1907 for repairing this same class of power was 9.40 cents per engine-mile, which is .98 cents or 9.1 per cent. less than the cost of repairs in 1903 under the same conditions. These figures show clearly that in spite of higher labor and material charges the cost of locomotive repairs per engine-mile is steadily decreasing and is approximately 10 per cent. lower than in 1903.

While locomotive repairs in cents per engine-mile are generally accepted as a basis for cost comparison on account of the acessibility of the records from which the figures can be compiled, a more accurate method is based upon a system of locomotive road units. The road unit adopted by the Santa Fe is defined as follows: "The weight of locomotive on drivers in pounds, multiplied by the engine mileage between consecutive shoppings costing $500 or over divided by 100,000,000." Dividing maintenance expense by the road unit gives the cost of repairs per road unit, which is a comparable quantity, for locomotives under all conditions of service. The road unit is based on the assumption that each locomotive handles full tonnage at all times, a condition which practically prevails under present operating methods. The accompanying diagram, Fig. 1, illustrates in a graphical manner the reduction in locomotive repair costs per road unit in the year 1906 as compared with the year 1905. It will be observed that the cost per road unit for the entire system in 1905 was $101, which in 1906 was reduced to $76 for freight and $66 for passenger locomotives, or an average of $71. This represents a reduction in cost of repairs of $30, or 39.4 per cent. per road unit in 1906 as compared with 1905. It is to be regretted that the road unit costs for 1907 are not available for publication at this time, as an even greater reduction is shown than for preceding years.

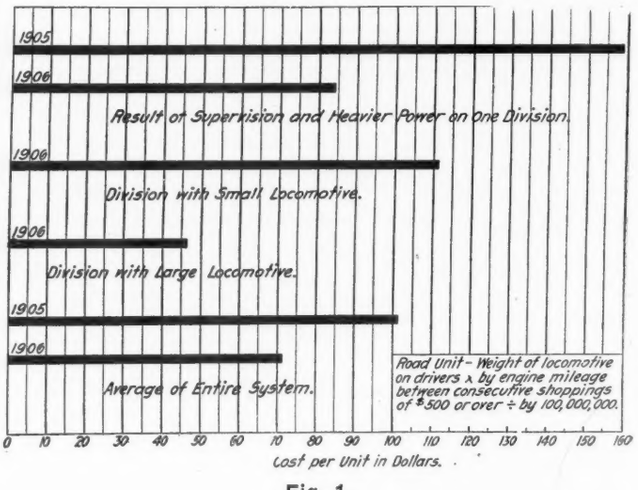


Fig. 1.

Among the factors entering into cost of locomotive repairs, labor is not only the largest in point of cost but also the most important. Labor is the one element that is directly under the control of the railroads. While the wage rate is more or less a product of commercial conditions it remains with railroad managements to obtain a labor output commensurate with the price paid.

The cost of labor in all branches of industry has been steadily increasing for the past 10 years or more. The wage rate for railroad machinists, as given by Slason Thompson, has increased from $2.23 in 1897 to $2.87 in 1907, or 29 per cent. Unless an output proportional to this increased labor charge is obtained, the cost of locomotive repairs will necessarily

mount upward even though other conditions remain the same. On the other hand it is possible to obtain lower production costs even with higher priced labor by the application of scientific methods. This has been strikingly illustrated on the Santa Fe in the past five years. That the same proportional increase in wages has applied to skilled mechanics on the Santa Fe as previously indicated for other railroads is shown by the following figures: Average wage per day for the system in 1903, $3.40; 1904, $3.60; 1907, $3.88.

It will be observed that the rate in five years has increased 48 cents per day, or 14.1 per cent., and that the average wage paid skilled mechanics on the Santa Fe is $1.01 per day, or 35 per cent. greater than the average wages for this class of labor as compiled by Mr. Thompson.

With this high and constantly increasing rate a correspondingly greater labor cost for locomotive repairs might naturally be expected; but the diagram in Fig. 2 shows that the reverse is true. In 1903 the labor charge per locomotive was $1,950. In 1907 this had been forced down to $1,560, a decrease of $390, or 24.3 per cent. Thus with an increase of 14.1 per cent. in labor charges, the cost of this labor for locomotive repairs was reduced 24.3 per cent. in the five-year period, which is equivalent to a reduction of 38.4 per cent. This is due in some measure to the individual effort system of reward, as well as to betterment methods and the large increase in the size of locomotives. The first, through the payment of bonuses for extra effort, gave the incentive for greater individual output, and the second equipped the shops with facilities whereby each man's output was limited only by his own endeavor.

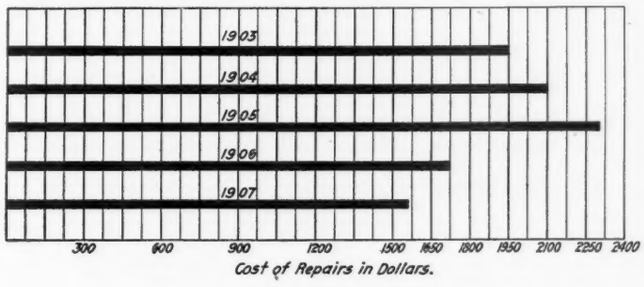


Fig. 2.

Referring to the diagram in Fig. 2 it will be noted that the cost of labor for repairs in 1905 was $2,300 per locomotive, or $740 higher than in 1907. In 1904, 156 locomotives of the largest size were added to the equipment which necessarily came in for repairs the following year. Labor conditions were also very unsettled. Late in 1904 the betterment work was inaugurated along with the individual effort system so that the principal development work took place in 1905. The workings of the new organization from that time on are shown clearly by the diagram.

Next in importance to the labor charge in locomotive repairs is the item of material. For the past 10 years there has been an upward tendency in the cost of all materials that enter into locomotive construction. With the advent of the heavy power, now common to the principal railroads, taking a greater amount of material and at a higher cost, the material item has assumed proportions that is directly manifest in the cost of locomotive repairs.

As shown by the diagram in Fig. 3, the average material cost for locomotive repairs in 1903 was $840 per locomotive. In 1907 this material charge was $1,147 per locomotive, an increase of $307, or 36.5 per cent., in the cost of material purchased by the Santa Fe for locomotive repairs. Considering the items of labor and material it has been shown that the first during the five-year period increased in cost 14.1 per cent. and the second 36.5 per cent., so that the combined cost of labor and material in 1907 represents a figure 50.6 per cent. above that in 1903. In the face of this enormous increase in cost of the two principal items entering into locomotive repairs, the cost of repairs per engine-mile from 1903 to 1907 was reduced 9.1 per cent., which is substantial evidence of progress in shop methods and locomotive design.

Conditions under which locomotives are operated have a direct influence on the cost of repairs. Thus, service in districts where "bad water" prevails results in higher maintenance charges for boilers. Also, renewals of fireboxes are much more frequent and expensive where oil is used for fuel than where coal burning locomotives are used. Service in the mountains over heavy grades is much harder on a locomotive than on the plains, consequently repairs are higher for the same mileage. All of these factors enter into the cost of locomotive repairs and should be considered when making cost comparisons.

Locomotives are now operated on a maximum tonnage basis. The greater the capacity of a locomotive the greater the load it must haul. In oil burning districts the hauling capacity of a locomotive is much greater than of the same type burning coal, owing to the greater evaporative efficiency of oil. This means that a higher firebox temperature is maintained. The effect of this high temperature is rapid deterioration of firebox sheets, necessarily involving frequent repairs and replacements with high maintenance and repair charges. The extent of this necessary firebox work on the Santa Fe largely arising from the causes as outlined is expressed by 143 new fireboxes applied to locomotives in 1907. This is one of the items contributing to a higher cost of locomotive repairs that did not exist under former conditions of tonnage rating.

Another factor which bears directly on locomotive repairs is the manner in which locomotives are handled on the road. The wear and tear on the heavy locomotive of to-day hauling tonnage trains is enormous. Not only is the highest class of shop and roundhouse repairs necessary, but also the most careful and expert handling on the road, to obtain the requisite mileage from locomotives between shoppings. During the past few years when the capacity of the railroads was taxed to the utmost, all efforts were concentrated toward moving the traffic. Economy and efficiency were necessarily sacrificed in the great struggle to handle the business. Methods were not questioned so long as the traffic moved. This injected a new spirit into the road organization which might be called "indifference." It is a product of conditions, but nevertheless its existence is real and directly traceable in increased expenses.

The last factor to be considered as entering into the cost of locomotive repairs is that of shop methods and facilities. It goes without saying that under the present conditions of high wages of labor and high prices of material, the best shop facilities are necessary to keep repair costs within a conservative figure. The reduction made by the Santa Fe in locomotive repairs the past few years is indicative of the progress in improved shops, facilities and organization.

The wide publicity given the "Betterment Methods" and "Individual Effort System" on the Santa Fe makes it unnecessary to discuss them at this time, but they are largely responsible for the steadily decreasing cost of locomotive repairs and renewals.

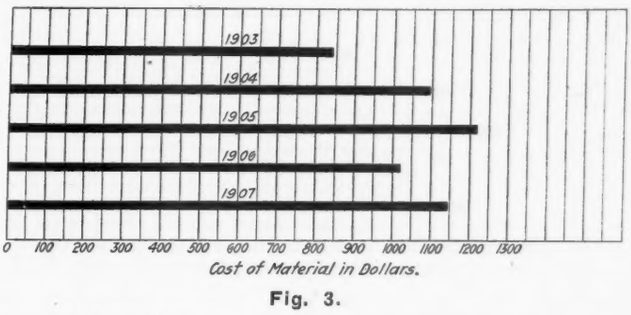


Fig. 3.

In conclusion it may be stated that the cost of locomotive repairs is not satisfactorily expressed in cents per engine-mile. A unit should be used that takes into account the work done by the locomotive. An absolute value is then given to the figure showing the cost of repairs. This is illustrated by Fig. 1, which shows the actual reduction in repairs to locomotives based on a road unit that represents conditions. The present tendency toward higher locomotive repair costs is not on account of any deficiency in design of locomotives or maintenance and repair methods, but in the ordinary mile unit used in expressing the cost of repairs.

COAL BRIQUETTES AND THEIR USE IN RAILROAD, MARINE AND DOMESTIC SERVICE.

BY F. R. WADLEIGH,
Fuel Expert, Castner, Curran & Bullitt.

It is probable that fuel briquetting had its origin in China. Mr. Williams, in "The Middle Kingdom," speaking of the coals of China, says: "Anthracite is powdered and mixed with wet clay, earth, sawdust or dung in the proportion of 7 to 1 and the balls made are dried in the sun." Bjorling, in "Briquettes and Briquette Machinery," says that, according to Menzel the ball-shaped compressed coal briquette was first made in China. In a pamphlet published in 1603, Hugh Platt describes a compressed fuel, made in 1594 near Lukeland, Germany, of coal dust, sawdust and oak tanbark with cow-dung as a binder. In 1776 balls and eggs were made of coal-dust with 10 to 15 per cent. clayey loam as a binder, near Aachen (Aix-la-Chapelle). In 1773 the first patent relating to the subject was filed in the British Patent Office, which is probably the first published specification on briquetting. Since that date there has been a steady issue of patents covering briquetting machines, binders and fuels.

According to Bjorling the first real factor for making briquettes was established about 1832 at St. Etienne, France. The following dates are also given for the first establishment of briquette factories in the countries named:

France	1842	Austria	1858
England	1846	Germany	1861
Belgium	1852		

The first use of hard pitch as a binder is credited to William Wylam, of Newcastle-on-Tyne, whose patents included the machine, the binder and, in fact, the whole operation. An analysis of Wylam's "Patent Fuel," as it was called, made by the British Admiralty, is as follows:

Specific gravity	1.10	Sulphur	1.25
Carbon	79.91	Oxygen	6.63
Hydrogen	3.69	Ash	4.84
Nitrogen	1.68		

The commercial manufacture of briquettes has been an established industry in Europe for nearly 50 years. At present the total output of briquettes in European countries is over 30,000,000 tons. Germany, during the first ten months of 1905 and 1906, had the following output, in metric tons:

First 10 mos., 1905.	First 10 mos., 1906.	Increase.
10,589,951 metric tons.	12,066,857 metric tons.	1,476,906 metric tons.

In 1906, 600,000 tons were exported.

England in 1906, exported 1,367,558 tons, of which 302,263 tons went to Mexico, South America and the West Indies.

In the United States little attention has been given to fuel briquetting, mainly because of the abundant supply of raw, cheap fuel available. Many patents have been issued for machines and binders and a few plants have been established, but most of the attempts to make fuel briquettes commercially have failed, partly because of the low cost of coal, but also on account of the ignorance of those interested of the proper materials and methods. At present the entire output of the United States is probably not over 175,000 tons a year.

The largest plant now in operation in North America is said to be at Bankhead, Alberta, Canada, operated by the Bankhead Mines, Limited. This plant was put in operation in March, 1907, and has an output of 300 tons per 24 hours. It uses British Columbia coal and coal tar pitch. Most of the product is said to be used by the Canadian Pacific.

The ends to be attained by fuel briquetting are as follows:

1. The use of inferior and waste fuels.

2. The production of a fuel that (a) will bear handling and transportation with the minimum amount of breakage; (b) that will burn without smoke or smell; (c) that will not fuse or coke together when burning; (d) that will make no clinkers; (e) that will give the greatest number of heat units per foot of space occupied.

3. To make poor fuel good and good fuel better.

Fuels Used.—The following is a list of raw fuels that have been used or proposed in making briquettes:

Coal dust, or slack, anthracite and bituminous.
Lignites,
Peat,
Sawdust,
Coke-breeze,
Petroleum refuse.
Cow-dung,
Tanbark,
Seaweed,
Charcoal,

Coals.—At the St. Louis testing plant of the U. S. Geological Survey briquettes were made of nearly all the coals tested, and it was found that under proper conditions suitable briquettes could be made from all of them. At the Jamestown Exposition the Geological Survey had a briquette-making plant which carried this work on further, using Virginia and West Virginia coals, all of which made excellent briquettes. The West Virginia samples included one of "Bone" coal, from the Pocahontas field. This is an impure coal, high in ash and rejected in mining, yet it made an excellent briquette for domestic use.

Briquettes were also made for the U. S. Navy and for several railroads, the fuels used being Pocahontas and New Rivers Kanawha run-of-mine coals.

Slack Coal or Screenings.—At present slack coal full of slate or other impurities is washed and finds a ready market. In this washing process, however, there is a loss in weight and an added cost of production. This raw fuel can be briquetted without washing and the briquettes will give additional weight and much higher duty under boilers than will the raw washed coal. Briquettes can be made from the slack or screenings of any coal and will give better results than the screened lump of the same coal.

Coke Breeze.—Coke breeze is now a total loss to the coke makers and buyers, and large amounts of it are wasted at every coke plant and iron furnace. Yet it can be briquetted either alone or mixed with bituminous coal. Briquettes made from it are tough and strong and burn without disintegration, with only a little flame and no smoke. They will not fuse when burning and are completely consumed, leaving no carbon in the ash, making an ideal fuel for domestic use.

The Semet-Solvay Co., of Detroit, has been experimenting with making coke breeze briquettes for the past three years and is now selling them for domestic use.

"Bone" Coal.—In some of the Eastern coal fields there are large amounts of an impure coal called "bone," rejected in mining. At some mines this bone is crushed and mixed with the slack for coke-making, but at most places it is an absolute loss and an added cost to the mine operator, as it has to be removed or burned up.

There is no doubt that although it runs high in ash (from 15 to 30 per cent.), there is sufficient heating value in the bone to make its use successful if it be briquetted. Briquettes made from bone, containing 26 per cent. ash, from the Pocahontas field, gave excellent results under boilers and in domestic plants and there was no smoke whatever.

Lignites.—Lignite or "brown" coal is not a true coal, but coal in the process of formation, high in moisture and low in carbon. It will not bear transportation or storing, as it slacks very quickly. It contains large proportions of water and oxygen and its heating value is therefore very low. When freshly mined it may contain as high as 50 per cent. moisture. When briquetted, however, it makes a fuel little inferior to good coal, will stand handling well and burns with little or no smoke.

The manufacture of lignite briquettes has been a well-established industry in Germany for many years and its development in our country is only a question of time; as it will enable us to use the great beds of lignite in the West and South. In North Dakota, Montana and Wyoming alone it is estimated that there are 55,000 square miles of lignitic coals in seams running from 20 to 80 ft. thick. There are also large deposits in Texas and Alabama, besides those on the Pacific coast. At the last meeting of the American Society of Mechanical Engineers, Dr. F. E. Junge said:

> "The heat value of brown (lignite) briquettes ranges from 7,700 to 9,600 B. t. u. per pound, compared with an average of 4,900 B. t. u. per lb. of raw lignite containing 45 per cent. moisture. This heat density is such that up to 3 tons, or 60,000,000 B.t.u. can be stored in a space of 100 cu. ft. Hence their commercial distribution range is almost double that of raw coal."

In Germany, lignite briquettes are largely made without the use of a binder, which reduces the cost of manufacture. This it is not possible to do with the true coals. The application of heat to some lignites generates sufficient resinous materials to act as a binder, and may be done either by direct application of heat or by the heat developed in pressing the water out of the raw fuel.

It would seem, therefore, that the railroads running through

or near the large lignite deposits have before them very promising possibilities in the way of a cheap, smokeless and "clinkerless" fuel, the latter two features of which, at least, they are sadly in need.

Binders.—The briquette binders that have been used and suggested are numerous and various, as the following partial list will show. (U. S. Geol. Survey Bulletin 290.)

Inorganic.

Clays,
Lime,
Magnesia,
Magnesia cement,
Plaster of Paris,
Cements.
Slag cement.

Organic.

Rosin,
Pitch,
Wood tars,
Wood pulp,
Sulphite liquor.

Starch.

Corn starch,
Potato starch.

Sugar Factory Residues.

Beet pulp,
Lime cake,
Molasses.

Slaughter-House Refuse.

Tars and Pitches from Coal.

Blast-furnace tar,
Product gas tar,
Illuminating gas tar,
By product coke over tar,
Coal-tar creosote.

Natural Asphalts.

Impsonite,
Gilsonite,
Maltha,
Trinidad, refined,
Bermuda, refined, etc.

Petroleum Products.

Crude oil,
Residuum,
Water-gas tar,
Water-gas tar, pitch,
Wax tailings,
Acid sludge,
Asphalt tar,
Pintsch gas tar.

The above substances were all tested as binders by the U. S. Geological Survey. In addition to these, numerous other binders have been used in Europe, such as acetate of lead, borax, bicarbonate of soda, gutta-percha, manganese, meal, saltpetre, salt, silica, etc.

W. S. Blauvelt states, in the *American Gas Light Journal*, of September 23, 1907:

"The development of the fuel briquetting industry is of peculiar interest to manufacturers of coal gas, because coal tar pitch is the only binder which has proved a commercial success. Hence, successful briquette manufacturing depends on a sufficient supply of coal tar pitch at a reasonable price; on the other hand, the success of the fuel briquetting industry will make a much greater market for pitch."

Coal tar and water gas pitch have undoubtedly been proved to be the best binders and on their price depends largely the success of fuel briquetting in this country. Coal tar is a by-product of illuminating gas and by-product coke manufacture. The production of tar is increasing each year with the building of more gas plants and by-product coke ovens, with the result of lowering the market value of the tar.

Analyses of Pitches, U. S. Geological Survey, No. 48.

Hydrogen	3.97	4.72	4.56
Carbon	90.89	91.16	90.34
Nitrogen	1.05	1.16	.99
Oxygen	2.07	1.85	2.07
Sulphur	....	.58	.88
Ash	1.32	0.53	1.16
B.t.u.	15,807	15,087	15,876

The above analyses show how the addition of pitch will increase the heating value of coal when briquetted. It is obvious that a fuel made from this substance in the right proportions with a suitable coal will surpass any natural coal in heating value. (Mills & Rowan.)

The percentage of binder used varies with coals of different structure, but usually runs from 5 to 8 per cent.

Cost of Manufacture.—The cost of making briquettes varies somewhat with the location of the plant, but is, of course, mainly dependent on the price of the raw fuel and the cost of the binder used.

The following figures are given by various authorities:

Robert Schorr, Proceedings A. I. M. E., 1904, for Western America.

Labor	$0.16 per ton.
Oil and grease	.006 "
Stores	.01 "
Steam fuel	.04 "
Interest and depreciation	.05 "
Total	$0.266 "

C. M. Barber, Detroit Engineering Society, 1906:

"Mr. Schorr's figures coincide so closely with the writer's own estimates that we believe them sufficiently correct for approximate estimates near any large city."

Mr. Barber also gives the following estimates:

		Per ton briquettes.
Pitch	$7.50 per ton, 8 per cent.	$0.60
Anthracite culm	.50 " 67 "	.33
Slack coal	$1.60 " 25 "	.40
Cost of making		.266
Total		$1.596

E. W. Parker (Pro. A. I. M. E. 1907) gives the following cost (condensed) as found in New York City, using a Mashek press, making small briquettes for domestic use:

Pitch	$10.00 per ton, net.
Anthracite dust	1.25 per ton, net.
Net cost per ton of briquettes	$2.30

The writer's estimates are as follows:

		Per net ton.
Pitch	$8.50 per ton, 6 per cent.	$0.43
Slack coal		2.20
Labor and charges		.30
Total		$2.93

In this estimate, the locality taken is the Atlantic coast from Norfolk, Va., to New York City; the coal, good semi-bituminous slack, capacity of plant, 10 tons per hour, making briquettes weighing from 1 to 3 lbs. each, and including cost of loading in cars at plant.

(To be continued.)

THE LOCOMOTIVES OF THE EASTERN RAILWAY OF FRANCE.

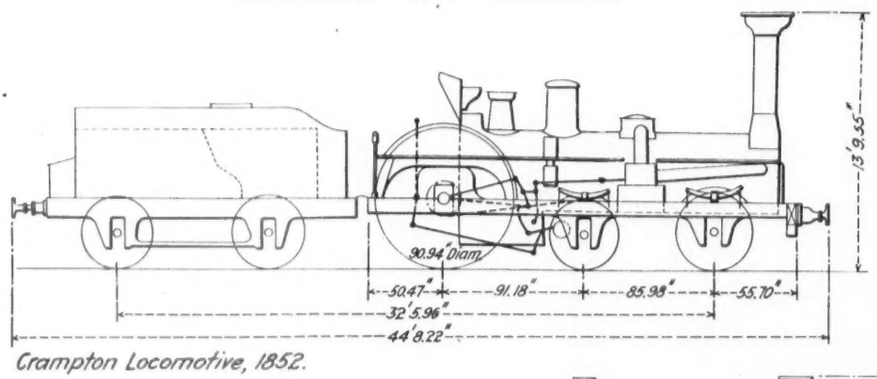
BY CHAS. S. LAKE.

The position occupied by the Eastern Railway among the railroad systems of France is in every respect a prominent one. The company operates close on 5,000 kilometers (3,107 miles) of track, and at the commencement of the present year had in service 1,509 locomotives of various types, while the estimates for locomotive construction during 1908 and 1909 provided for the addition of 170 engines, to include 92 six-coupled compound passenger engines, 26 consolidation type heavy goods engines, and 52 powerful shunting engines with eight wheels coupled. The total horse power of the locomotives, which, in 1900, amounted to 758,535 h.p., had increased by January, 1907, to 936,303 h.p., an advance of 177,768 h.p., or 23.44 per cent. and, when the programme of locomotive building provided for in the estimate to the end of 1909 has been carried out, the total horse power represented by the locomotives in use on the road will amount to 1,157,790. By that time, also, it is estimated that the number of passenger coaches owned by the company will have reached 4,000, and the number of goods wagons of all kinds, 45,200.

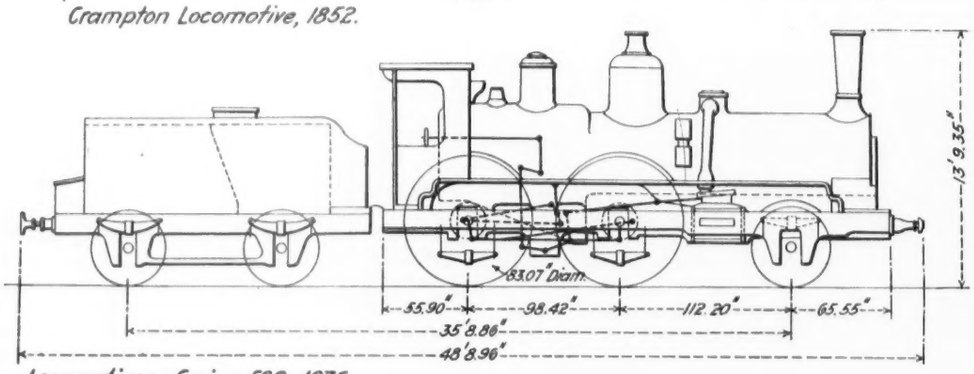
The company's system provides a direct means of communication between Paris, Eastern France, Belgium, Switzerland, Germany, Italy, etc.; indeed a large portion of the principal train services are of a wholly international character, so much so that it is possible at certain times during the 24 hours to stand in the Gare de L'Est at Paris and witness the departure of as many as three trains within a short period, having through carriages for different European capitals and other places of international importance. The official headquarters of the Eastern Railway locomotive department are in Paris, where an extensive suite of offices, situated in close proximity to the terminal station of the company, is allotted to the chief mechanical engineer and his staff of assistants. The locomotive works are at Epernay, 141 kilometers from Paris on the line to Avricourt and Strassbourg, and the carriage and wagon works are at Romilly, on the line to Belfort, 129 kilometers from Paris; at Mohon, 242 kilometers from Paris, near Mézieres; and at La Villette, one of the Parisian suburbs.

The present chief mechanical engineer is L. Salomon, who has occupied the position since 1886, a period of upward of 22 years, during which time the locomotive standards of the Eastern Railway have been gradually but completely transformed, with the result that at the present time it may safely be said that no European railroad can boast of a better locomotive equipment than this one. Mr. Salomon has as his principal assistant Eugene Flaman, who for many years has acted in the capacity of chief designing engineer of the motive power as well as the carriage and wagon department, and whose name is prominently associated in railroad and locomotive circles with the double boiler and speed indicator, of which he is the originator.

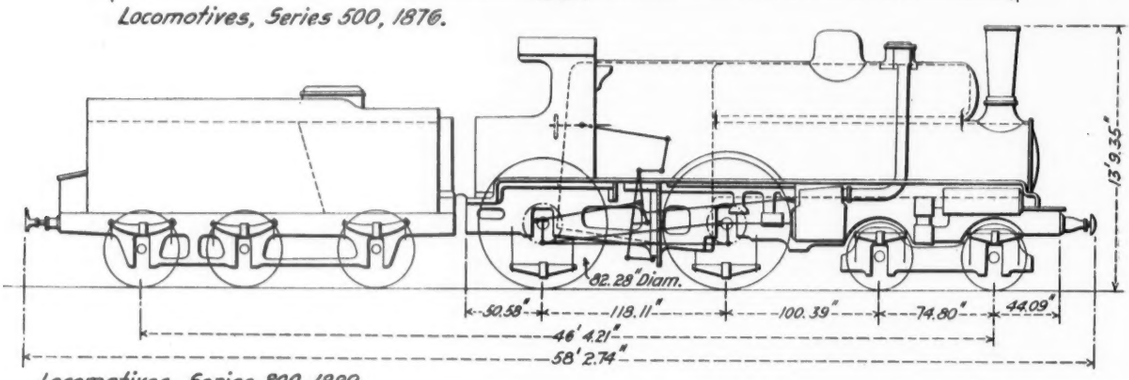
One of the accompanying charts shows graphically the successive developments in size and design of the express locomotives of the Eastern Railway during a period of 54 years, viz: from 1852 to 1906. In the former year, and indeed for some time subsequently, much of the express passenger traffic of the line was hauled by single driver locomotives of the Crampton type having a weight in working order, without



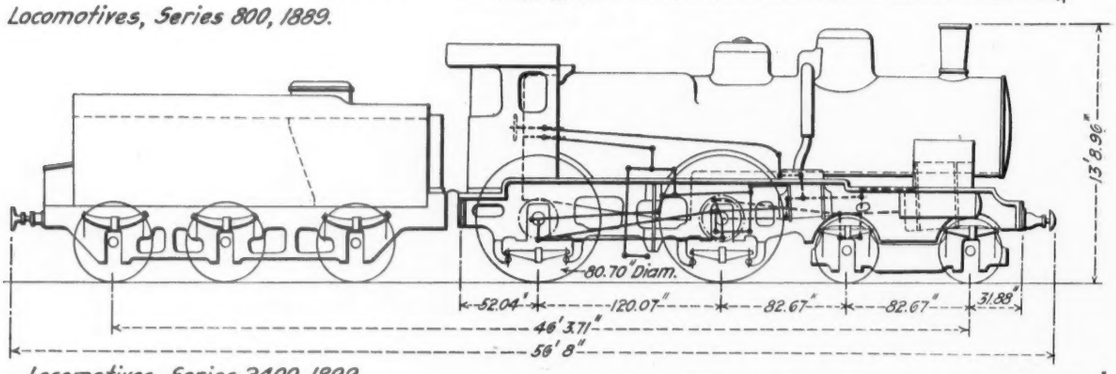
Crampton Locomotive, 1852.



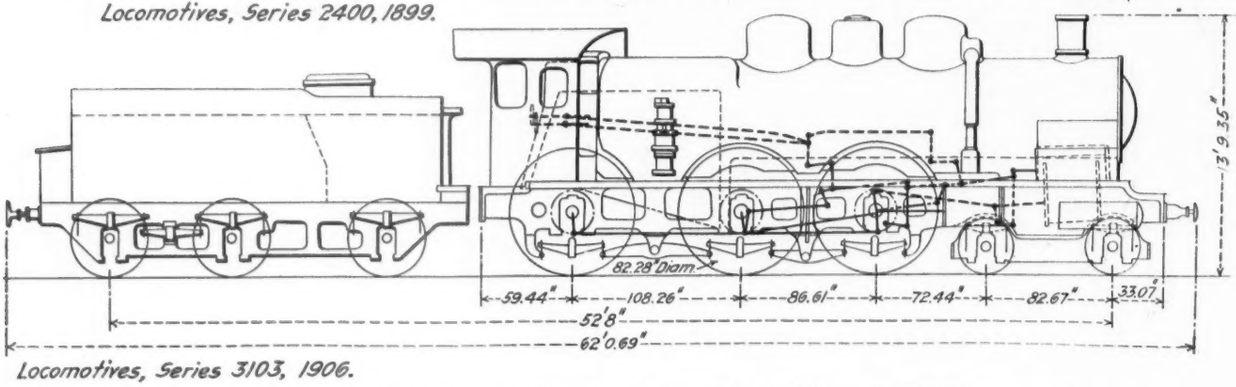
Locomotives, Series 500, 1876.



Locomotives, Series 800, 1889.



Locomotives, Series 2400, 1899.



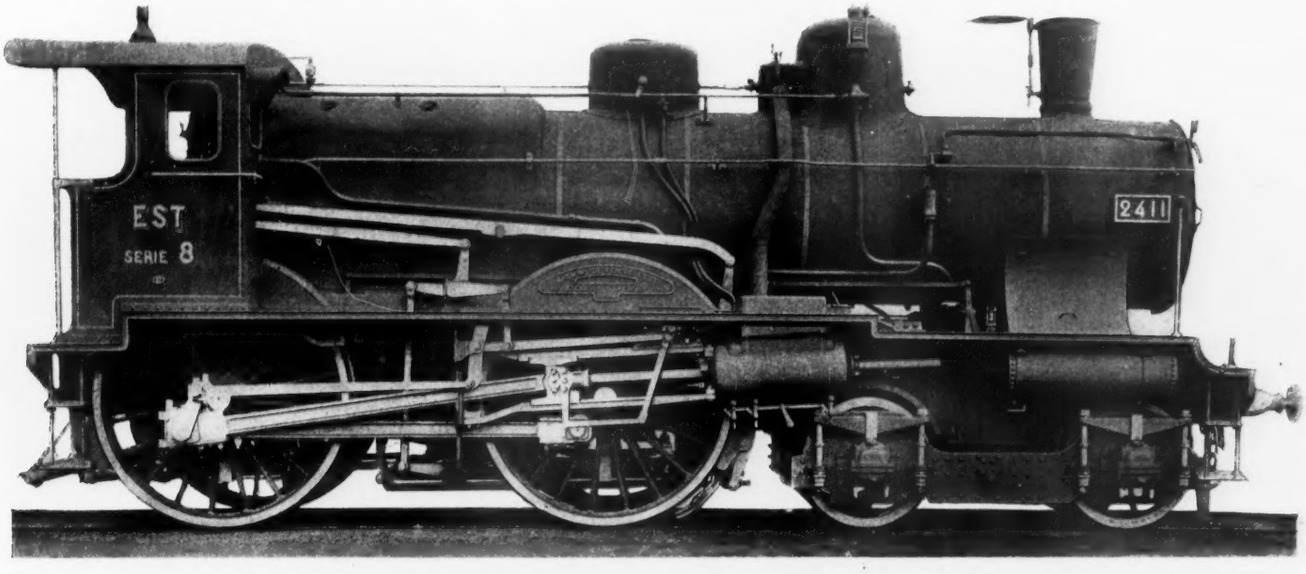
Locomotives, Series 3103, 1906.

Development of Express Passenger Locomotive; Eastern of France.

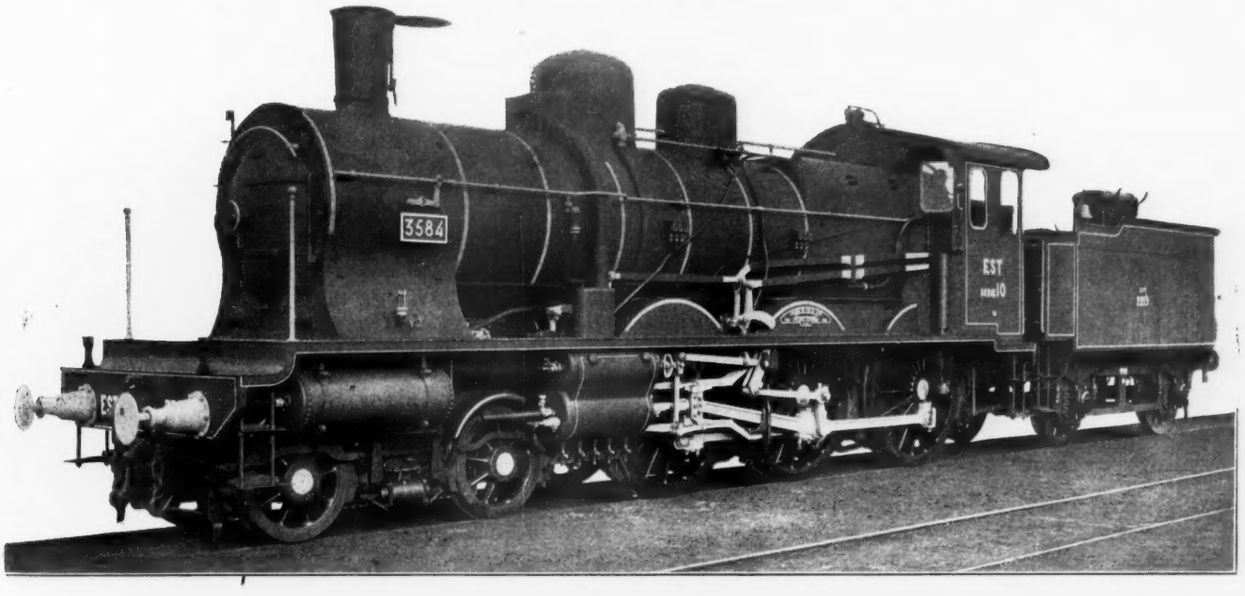
tender, of 27¼ tons and an adhesion weight of 10¼ tons, whereas the most recent locomotives designed by Mr. Salomon, which are four-cylinder compounds of the 4-6-0 type, weigh 78½ tons and have 53½ tons of adhesion load.

Throughout the 70's and 80's the heavier express trains of the Eastern Railway were dealt with by means of locomotives of the 2-4-0 type, class 500. These were two-cylinder simple engines, in which the driving wheels were the trailing pair. They weighed 45¾ tons in working order, of which 30½ tons was utilized for adhesion.

that it was decided to construct some new and powerful locomotives having the Flaman boiler and increased dimensions throughout, and in 1892 the first of a new series of such engines with two simple expansion cylinders and the 4-4-0 wheel arrangement was built, being followed later by a large number of others having the same characteristics. These locomotives were known as the 800 class, and an outline diagram of the design forms Fig. 3 of the accompanying chart. The next development was marked by the appearance, in 1899, of the 2,400 class engines, these being four-cylinder compounds on



Four-Cylinder Compound Eight-Wheel Locomctive.



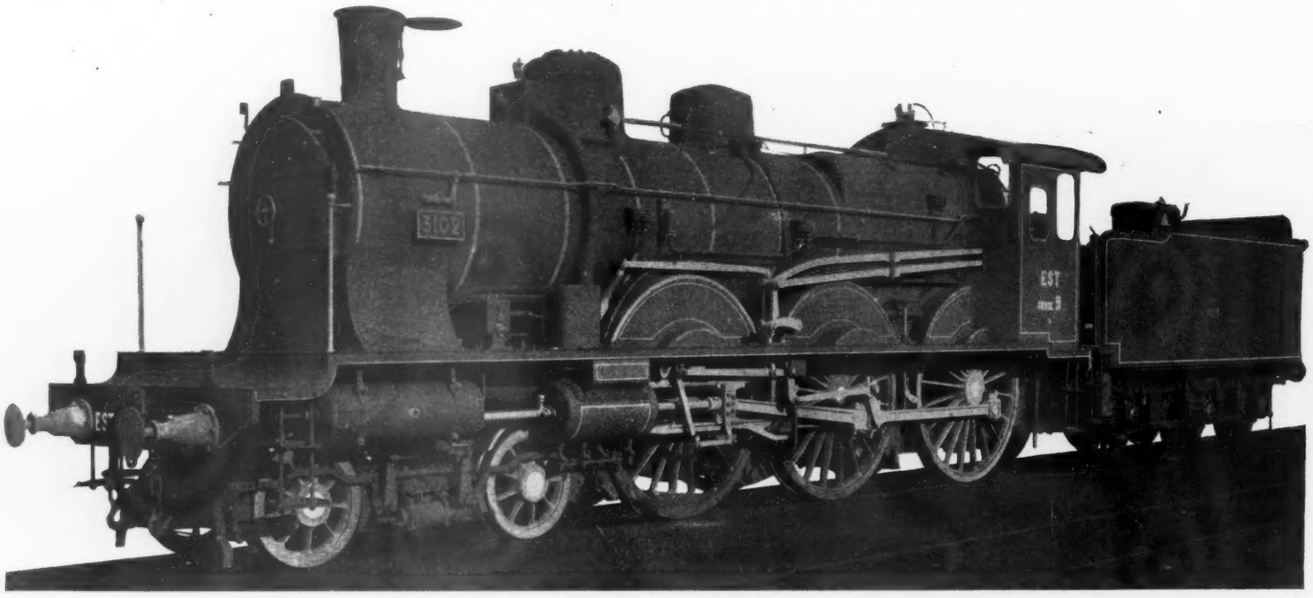
Four Cylinder Compound Ten-Wheeler for Mixed Traffic.

In 1891, one of the few Crampton engines (No. 604) remaining in service was taken into the shops at Epernay and fitted with the special type of boiler invented by Mr. Flaman, this being done in order that the idea might be fully tested before laying out a large sum of money on new construction. The result was to elevate what had been considered for some time previously a machine suitable only for dealing with traffic of minor importance to one capable of performing some of the heaviest work on the system.

So successful were the results which followed this process de Glehn's system and fitted with the Belpaire type of boiler and the 4-4-0 wheel arrangement. Although these engines have for some time past been superseded on the heaviest work by six-coupled, 4-6-0, locomotives of later design, they are still largely employed for hauling express trains other than those of maximum weight. The 4-6-0 type locomotives are divided, on the Eastern Railway, into two main classes, viz.: the 6 ft. 10½ in., 3100 class, which is used exclusively for hauling the heaviest and fastest passenger trains, and the 5 ft. 9 in., 3400 to 3700 class, principally employed for working fast goods and

perishable traffic, and also, but to a much less degree, in passenger service of a slower description.

The 6 ft. 10½ in., class 3100 engines represent the latest development connected with passenger locomotive design on the railroad to which they belong, and the writer believes himself correct in ascribing to them a distinctive character as possessing the largest driving wheels yet incorporated in a



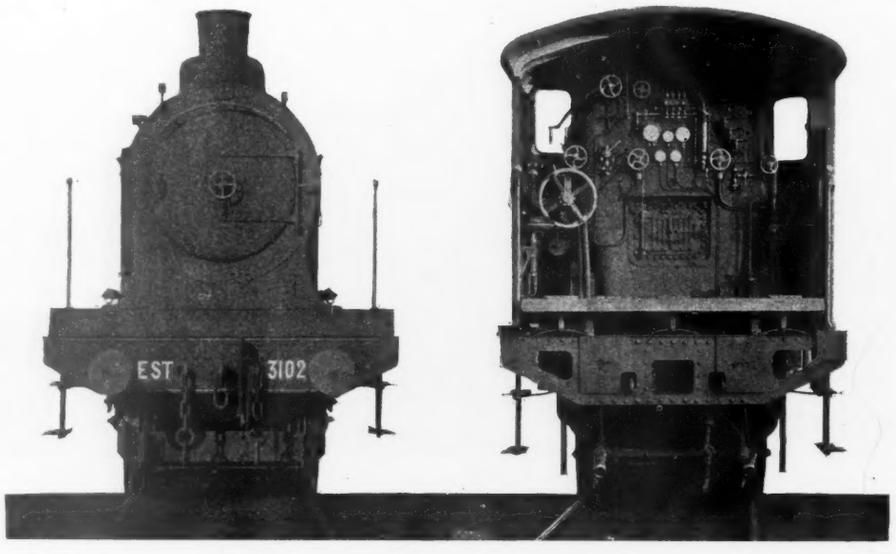
Largest Type of Express Locomotive.

six wheel coupled locomotive, built to a standard pattern, anywhere in the world. The engines were specially designed to replace the 4-4-0 type compounds (2400) class, on the heavy international express trains, many of which weigh well over 300 tons behind the tender, and they have to run considerable distances without stopping over lines abounding in gradients of marked severity. The 34 tons of adhesion weight on the two driving axles of the 4-4-0 locomotives was found, as time proceeded and the train loads increased, to be insufficient for the work to be performed, and it was therefore decided to employ a third pair of coupled wheels, so that without increasing the load per axle—the rule on the Eastern Railway is 17½ tons—a greater amount of adhesion might be obtained and correspondingly larger boiler and cylinder capacities employed with advantage.

The smaller wheeled 4-6-0 type, class 3400 to 3700 engines had, of course, been in service for some time prior to the introduction of the heavier class (3100) locomotives, but, although possessing ample power, they could not be used with advantage on the express trains because of the excessive piston velocity which would be set up at the speeds required, and it was the practice, until 1903, to divide the fast passenger work between the Flaman system two cylinder simple engines and the four cylinder 4-4-0 type compounds. Except in size, the two classes of six coupled express locomotives are identical in design, so far as all their main features are concerned, therefore the description of the larger engines, which follows, may be taken as applying in great measure to both classes.

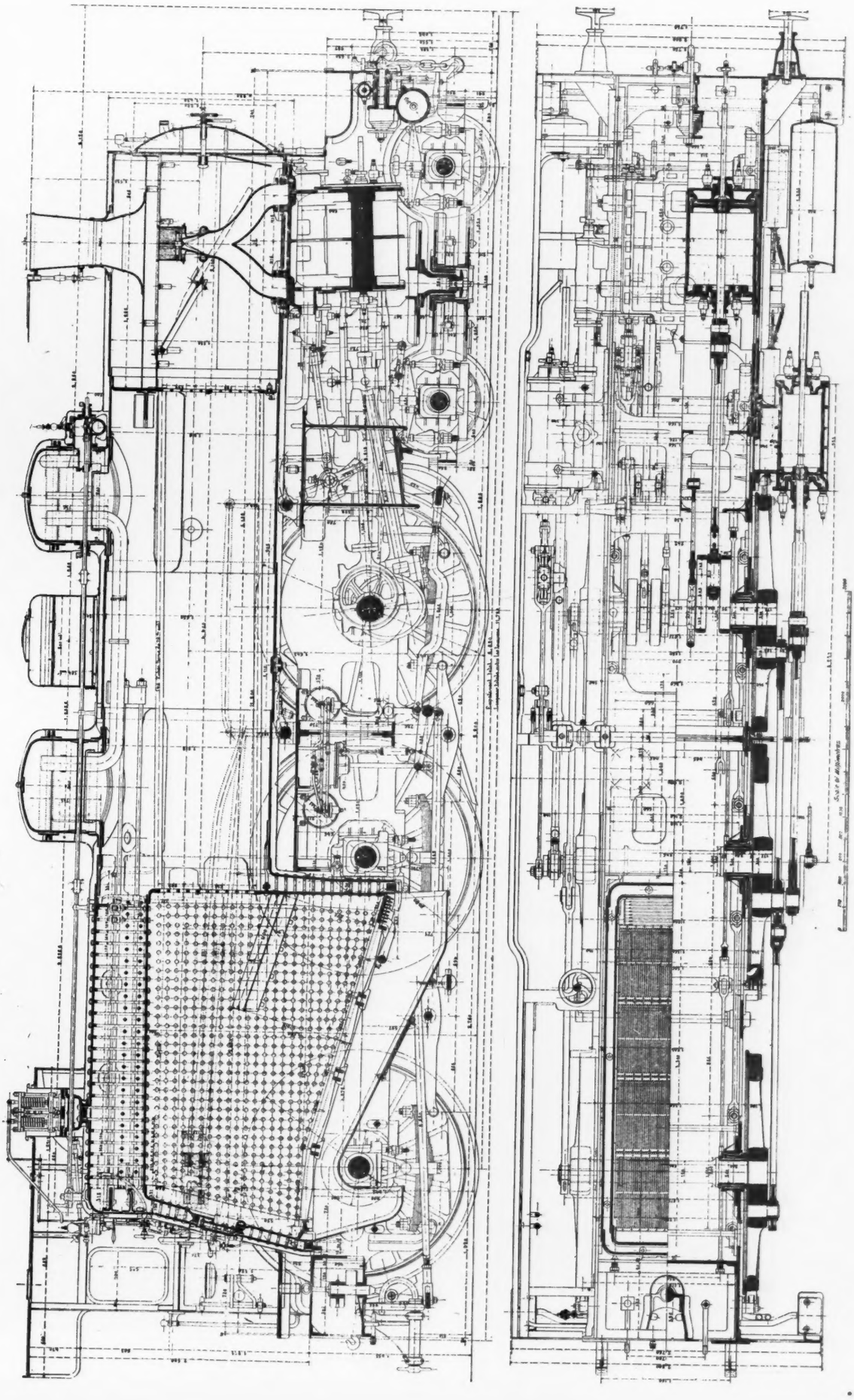
The four cylinders are compounded and arranged on the de Glehn principle, that is to say, the low-pressure cylinders are set between the frames below the smokebox, from whence they drive the crank axle of the leading coupled wheels, while the high-pressure cylinders, outside the frames, drive the middle coupled wheels from a position at the rear of the bogie center.

The outside cylinders are set horizontally, but the inside ones are slightly inclined to provide greater clearance for the bogie. The two inside cylinders are formed together with their valve chests and a large capacity receiver in one casting, shaped at the top as a saddle to support the smokebox. Steam distribution to each of the four cylinders is by means of piston valves, this being contrary to the usual practice of employing such valves for the high-pressure cylinders only and balanced flat valves for the low pressure. The piston valves used on the Eastern Railway differ somewhat from the usual pattern. Each valve is cast in one piece of iron, being afterward turned so as to play freely between the shoulders of the steel valve spindle. The parts are first turned to 258 m.m. ($10\frac{3}{16}$ in.) diameter outside, and 26 m.m. (1 in.) is then cut from their circumference, the rings being compressed to the working diameter with a piece 1 m.m. thick inserted in the cut and then turned up afresh with a truing cut.



Front and Rear Views of Express Locomotive.

Each piston valve receives motion from a separate valve gear of the Walschaerts pattern, the two valve motions of the inside cylinders being actuated by single eccentrics on the

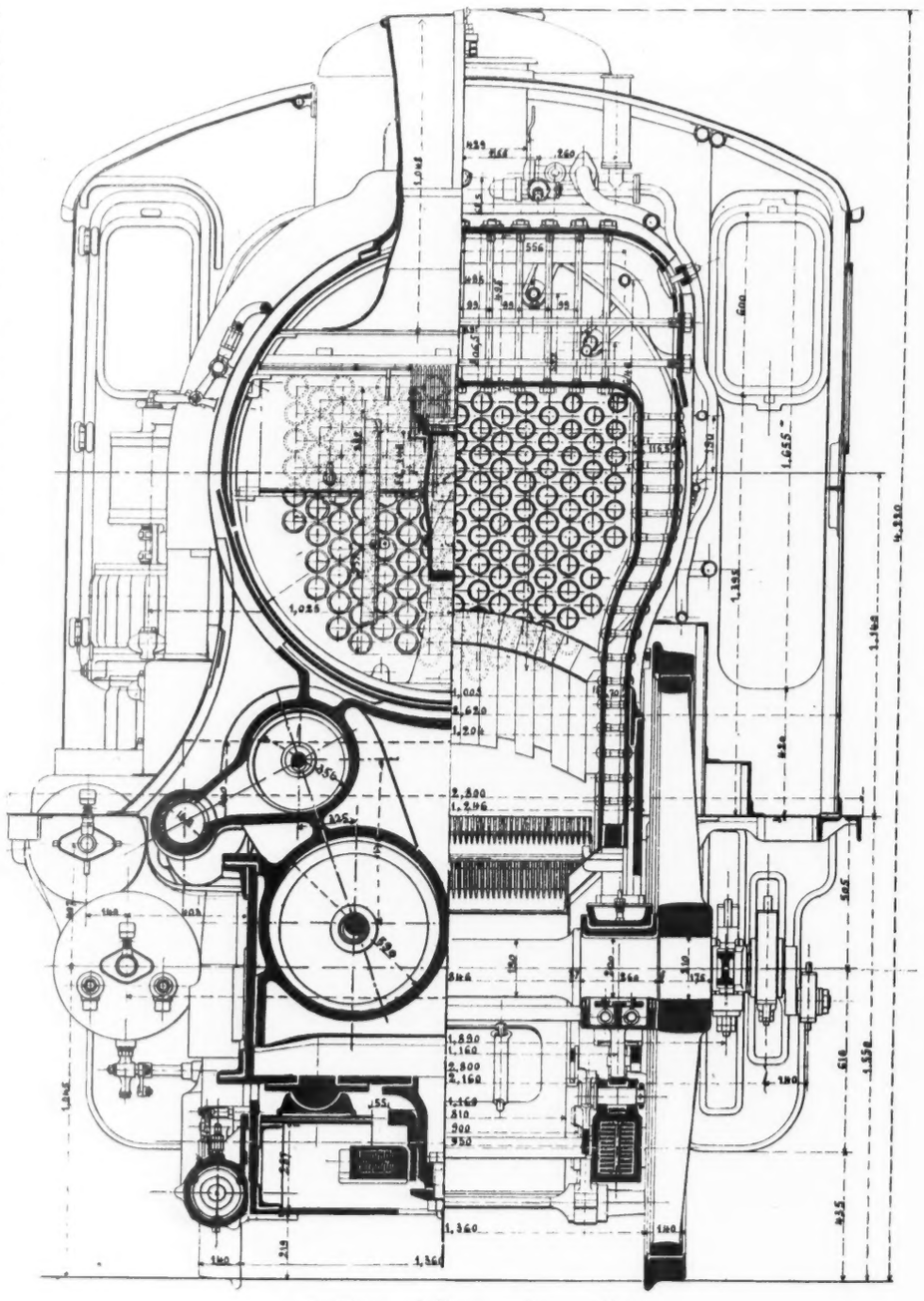


Four-Cylinder Compound Express Locomotive; Eastern of France.

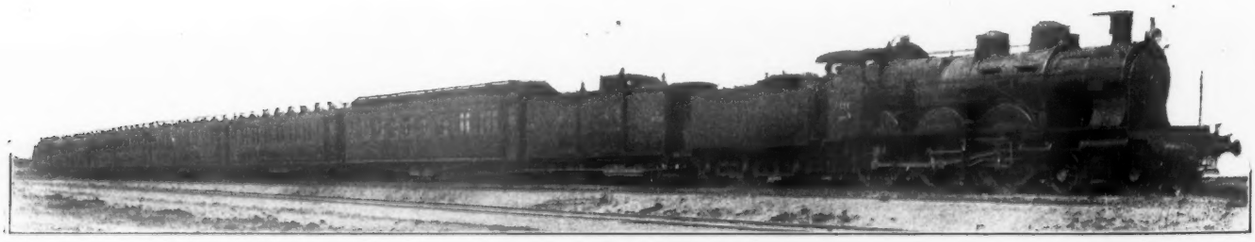
low-pressure driving axle, and the outside ones by return cranks fixed to the crank pins in the high pressure driving wheels. Reversing of the valve gears is effected in all degrees of cut-off in both pairs of cylinders, either simultaneously or independently of each other. It is done by the usual arrangement of twin screws operated in unison by a single hand wheel transmitting motion through pinions and ratchet gear. Each valve spindle is provided with a buckle which includes a device for taking up wear in the pins of the lead lever, radius rod, and link block, so that the valves are kept in due alinement on the ports without varying from their original setting. The four pistons and piston valves are fitted with tail rods working through stuffing boxes in the front covers. The engines are provided with starting mechanism consisting of a special box fitted to the receiver and containing a flap valve which serves to separate the high-pressure from the low-pressure cylinders, and another valve which opens a direct escape from the former, thus allowing high-pressure steam to be exhausted directly into the atmosphere; high-pressure steam can also be admitted to the low-pressure cylinders straight from the dome, through a special box which contains a horizontal sliding regulator valve, by means of which and the pipe outside the boiler, steam is admitted to the high-pressure cylinders. Copper pipes connect these cylinders with the intermediate receiver cast in one piece with the low-pressure cylinders. The steam pressure is regulated in the receiver so as not to exceed 60 lbs. per sq. in. by a relief valve placed just behind the saddle casting and loaded for a pressure of 85.4 lbs. per sq. in.

In the first engines the valves and cylinders were lubricated by a Friedmann mechanical lubricator of the telesco-pump type, but in more recent engines the latter has been superseded by condensing lubricators of the Friedmann type. Kubler's patent packing is used in the piston and valve rod stuffing boxes throughout.

The two crank pins on each side of the engine, one for the high-pressure and the other for the low-pressure cylinder, are set 180 degrees apart and at angles of 90 degrees to the opposite pair of cranks. In the class 2,400 four-coupled locomotives,



Sections of Express Locomotive.



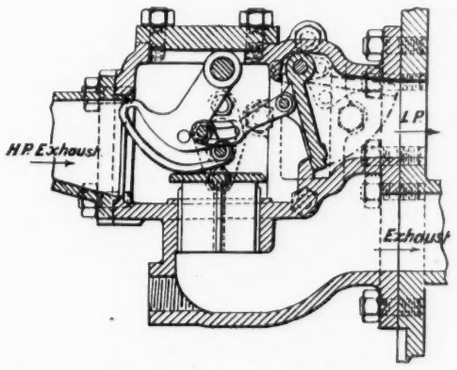
Express Train and Four-Cylinder Compound Ten-Wheeler.

the high-pressure crank pin stands at an angle of 162 degrees to, and in advance of, the low-pressure crank pin on the same side of the locomotive, but this plan has not been followed in the case of the 4-6-0 type engines.

The wheels and axles are of steel throughout, the wheel centers being of cast steel with Siemens Martin axles, and the tires of Siemens Martin steel. The whole of the revolving weights are balanced in the driving wheels. The main frames of the engine are formed of steel plate having a thickness of 27 m.m. (1 1/16 in.). They are strongly cross embraced at several points. The low-pressure cylinder casting in front and the drag plate at the rear form strong end supporting elements, and in addition there is a strong box casting stretching across between the high-pressure cylinders; this casting also supports the low-pressure slide bars at their rear ends, as well as brackets for the reversing and valve gears and other attachments. A steel stay plate braces the frames between the high-pressure and low-pressure driving wheels, and the buffer beams are also of steel.

The boiler barrel is of mild steel plate in three rings, of which the middle one is the largest in diameter. The ends of the first and third rings are connected by double riveted lap joints to the middle ring.

The smokebox is of considerable length and is fitted with a deflector plate and spark-arresting device. The boiler contains 140 tubes of the Serve pattern, and the mountings on the barrel consist, in the latest engines, of two steam domes with a cylindrical sandbox between them. The idea in providing two domes is to collect the steam at a point near the



Starting Valve for Compound Locomotive.

firebox where the greatest heat is available and to pass it forward through an internal pipe above the water level to the forward dome, against which the regulator box is fixed and which is nearer the high-pressure cylinders. This method of locating the connecting pipe between the two domes, inside instead of outside the boiler, as is usually done, possesses distinct and obvious advantages.

The firebox is of the Belpaire type and of ample proportions. The grate is inclined 16 degrees from the horizontal; it is formed in five sections, in four of which the firebars are placed longitudinally and in the fifth transversely. These are fixed upon a shaft, by means of which they are worked as fire-dropping apparatus. The water spaces have been made as large as possible, and both at front and rear they have a maximum width of 5¼ in. The back plate slopes toward the rear, commencing at a point over the rear edge of the top of the interior copper firebox. The trailing coupled axle passes underneath the ash pan near its rear end, the ash pan itself being specially shaped to allow this. The safety valves are mounted over the firebox and are partly enclosed within the prow formed by bringing the front sheets of the cab together at an angle of 90 degrees. These valves are of the Adams type and loaded for 220 lbs. steam pressure. The boiler feed is maintained by two Friedmann injectors, type H, of 9 m.m., 5.

The engine is equipped with the Westinghouse brake with compound air pump on the Fives-Lille system. The brake blocks are applied to the coupled wheels by means of vertical cylinders taking compressed air from transverse reservoirs, one on each side of them; the whole arrangement is carried below the boiler and between the high-pressure and low-pressure driving wheels. Brake blocks also act on each of the four bogie wheels, these being applied by horizontal cylinders with separate air reservoirs altogether independently of the brake mechanism of the coupled wheels. Both the spring and brake rigging of the coupled wheels are compensated throughout, and the springs of the bogie, consisting of a plate spring over each axle box, are compensated by a system of links and bell cranks. The maximum brake power exerted is equal to 75 per cent. of the weight on the rails.

(To be continued.)

COST OF HANDLING LOCOMOTIVE COAL AND ASHES.

In a paper recently read before the Canadian Society of Civil Engineers, C. F. Whitton presented a compilation of data regarding the cost of handling locomotive coal and ashes, as developed in the use of various appliances. He reduced the total expense to a tonnage basis, including fixed, operating, maintenance and pro rata charges.

The fixed charges, which comprise interest, depreciation, insurance, and taxes, have been taken as 10 per cent. of the total initial cost of the plant. Maintenance and operating charges vary so widely with local and climatic conditions, that, considering also the short time over which the costs obtained extend, they can hardly be considered exact, and certainly not applicable, except as an indication of general results. Pro rata charges are estimated as follows: The proportion of the time of yardmaster, clerks, etc., is distributed to the different departments on a labor output basis, and the per cent. added to the cost of handling coal and ashes is the proportion of the above wages based on the ratio which the labor charges for each of these departments bears to the total labor charges of all the departments of the yard. By several railroads, this amounts to about 20 per cent. of the labor charge for the coal and ash handling plants.

The cost of coal handling with a locomotive crane was based upon that obtained at the Cleveland yards of the Erie Railroad, and is as follows:

a.	Average number of locomotives fueled per day	25
b.	Average tonnage per 12 hours	168
c.	Maximum actual tonnage per 12 hours	180
d.	Total tonnage for year 1906	60,500

The initial cost of the crane was $7,400, and the cost of bucket, pits, etc., is estimated at $4,600. The handling costs per ton are made up as follows:

Average tons handled per day	166	
Fixed charges, per ton	2	cents
Operating charges, labor	2	"
Operating charges, power and supplies	3.5	"
Maintenance charges	0.3	"
Pro rata charges	0.4	"
Total cost per ton	8.2	"

(N. B.—No ash handling costs were available for this plant.)

Other locomotive crane plants show the following costs:

Coal Handling.

Location.	Buffalo.	Leipsic.	Bellevue.	Ft. Wayne.	Conneaut.	Stoney I'd.	Cleveland.	Mina.	
Year	1905	1905	1905	1905	1905	1905	1906	1906	
Average tons per day	176	116	230	153	106	45	166	218	
Fixed charges	1.9	1.7	1.8	1.8	3.7	7.9	2.0	1.5	cts.
Operating charges	4.7	6.1	3.6	5.1	3.0	5.5	5.5	3.5	"
Maintenance charges	0.5	0.2	0.7	0.5	0.4	0.2	0.3	0.1	"
Pro rata charges	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	"
Ttl. charge per ton.	7.5	8.4	6.5	7.8	7.5	14.0	8.2	5.5	"

Ash Handling.

No. of locomotives cleaned per day	20	13	26	17	12	5	19	25	
Cost per locomotive cleaned.	4.8	..	3.8	22.4	3.3	4.7	..	..	cts.

It is well, perhaps, to call attention to the fact that, in the above cases, the cost of handling ashes does not include any proportion of the fixed charges.

The actual cost per ton is not so important as a comparison of costs between old and new methods of doing the work. In the case of the Erie plant, at Cleveland, the reduction per ton due to the installation of a locomotive crane was

about 12 cents. At this plant there is another crane not in service at present.

The belt conveyor, as operated in the Cleveland yards of the Pennsylvania Lines West gave the following results:

The original cost of this plant was $13,000, and it is in operation for 10 hours per day.

Average number of locomotives fueled per day	50 to 75
Average tons handled per day (1906)	260
Maximum tons handled per day on a monthly basis	570

The labor connected with this plant includes one engineer in charge of the machinery, and two laborers.

The handling costs for 1906 are made up as follows:

Average tons handled per day	258
Fixed charges	1.4 cts.
Operating charges	2.8 "
Maintenance charges (belt renewal)	0.2 "
Pro rata charges	0.2 "
Total cost per ton	4.6 "

In these same yards the ashes are handled by an overhead trolley. The first cost of the pits and the mechanism was about $5,000. During 1906, the number of locomotives handled was upward of 18,000, and the cost per locomotive was as follows:

Fixed charges	2.4 cts.
Labor of operating plant	27.5 "
Cost of power and supplies	1.1 "
Maintenance	0.2 "
Pro rata charges	5.6 "
Total cost per locomotive cleaned	36.8 "

For the bucket conveyor the plant of the Lake Shore & Michigan Southern at Elyria, Ohio, served as an example. The capacity of the wharf is about 500 tons, and there are four 125-ton pockets.

Power is supplied to one conveyor by a 32-h.p. gasolene engine making 200 revolutions per minute. For the other system power is derived from a 60-h.p. gasolene engine making 160 revolutions per minute.

Rope transmission is used throughout.

The plant is operated by an engineer, a fireman, and two laborers.

The following figures represent the operation of this plant:

a.	Average No. of locomotives fueled per day	60 to 70
b.	Average daily tonnage—summer	300
c.	Total tonnage for year 1906	88,250

This plant, as originally installed, consisted of the main structure and one conveyor system, and cost $34,000. Later the second conveyor was installed at an estimated cost of about $15,000, but as one conveyor only is in continuous operation at present, the fixed charges have been estimated for the original cost of $34,000.

Average No. of tons handled per day	242
Fixed charges	3.9 cts.
Operation charges	2.8 "
Maintenance charges	2.1 "
Pro rata charges	0.4 "
Total cost per ton	9.3 "

The figures obtained from the trestle plant of the Lake Shore & Michigan Southern at Collinwood, Ohio, show that it handles from 550 tons per day in summer to 900 tons per day in winter, and that the delivery ranges from 5 to 15 tons per engine, with an average of 10.

The labor force consists of three laborers and a foreman, who also has charge of the ash-pit gang.

The original cost is estimated at $15,000, and the handling costs for 1906 were as follows:

Tons per day	635
Fixed charges	6.7 cts.
Operating charges	4.1 "
Maintenance charges	0.1 "
Pro rata charges	0.4 "
Total cost per ton	5.3 "

In the case of the ashpits at the same locality, their capacity is as follows:

Average number of locomotives having fires cleaned per day	58
Total number of locomotives having fires cleaned per year	21,000

The cost of handling ashes is estimated as follows:

Fixed charge	4.8 cts.
Labor	26.1 "
Power, supplies, etc.	1.2 "
Pro rata charge	4.8 "
Total cost per locomotive cleaned	35.7 "

Without attempting to draw any definite conclusions, it may not be considered out of place to make a brief comparison of the relative advantages and objections of the above types of coaling station.

In the first place, the locomotive crane has offered a very successful and moderately cheap method of handling coal and ashes in locations where the demands are not excessive. Its practical limit is said to be about 70 locomotives a day, as the capacity of the bucket is necessarily below 5 tons, and the number of trips per hour is restricted to about 50.

It is not as rapid as plants having gravity discharge from storage, but, as the engine is necessarily held over the ashpit for about 40 minutes, this feature is hardly objectionable, as delays to engines can be obviated by providing pockets.

The system proves a very flexible one on account of the diversity of arrangements possible. One disadvantage of open-air storage in pockets or pits, however, is the liability of the coal and gates to be frozen up in cold weather. With the necessary tracks, pits, and pockets, it will be found that this sort of plant has a considerable first cost. Its operating cost depends upon the work which can be provided at spare times. Its value is great in emergency situations, and at points where, because of impending changes, the construction of a permanent plant is unwise. With a large terminal where a conveyor plant is used, a locomotive crane can be very valuable to handle cinders and sand, and also coal during a possible breakdown of the conveyor. Then again not only can it unload direct from flat-bottom cars, handle ashes as well as coal, move to any spot desirable to stop the locomotive, but if superseded by a different system, can be easily moved to another point. These are a few of the points of interest concerning the locomotive crane, but within its proper sphere of capacity, it seems to prove one of the very best now in use.

The inclined belt conveyor has also several features of advantage. Besides having as low a first cost as any other handling system, the simplicity of the machinery reduces greatly the operating and maintenance expense, the latter, being mainly an allowance for belt renewal. A belt will handle large quantities of coal noiselessly and with little breakage, requires but about two-thirds the power of a chain conveyor, while practically the only attention necessary is occasional lubrication of the moving parts, and the taking up of slack. The troughing should not be so great as to cause the belt to crack, nor the coals so large as to cause the belt to run out of line and chafe at the edges.

Of course this system takes up considerable ground, but in certain locations, where plenty of space is available, a better storage yard for coal cars can be provided by this than by other types, as the receiving hopper is placed at some distance from the storage bin.

The belt system, however, has not the flexibility of the chain conveyor, which lends itself to the formation of many types of station, and can be adapted to almost any arrangement or local conditions. The latter takes up very little ground space, and can handle from 30 to 500 tons an hour, though it has a tendency to break up very soft coal.

Its main disadvantage is a somewhat higher initial cost than other systems, though stations with an actual daily working tonnage of about 75 tons can be built for $16,000 or $17,000; second, operation is inexpensive, but maintenance varies considerably, according to the care taken with the machinery. This contains many working parts, and, as the strains are pretty severe, the excessive wear at the link-articulations, unless very well lubricated, will cause considerable uneven elongation to take place. This seriously affects the life and efficiency of the system, and repairs and restoration of parts may greatly increase the cost of maintenance. Many of these plants, however, are in operation at present, and, when well cared for, they give excellent service at a reasonable cost.

The trestle system, with gravity discharging pockets, and a steep or light grade approach (according as the cars are placed by yard engines, or by some other power), has, perhaps, the most widespread use of all types of plants already described. Its advantages are cheapness and simplicity of design and operation. In locations where a large number of locomotives are handled and two tracks only are to be served, it has proven very satisfactory and economical.

General News Section.

The Lake Shore & Michigan Southern has about finished a telephone line between Buffalo and Erie, 88 miles, which it is proposed to use as a train wire in place of the Morse telegraph.

The special session of the New York State Legislature, which has just adjourned, has reappropriated the sum of $308,000 to be used toward the abolition of highway grade crossings. It is said that the Public Service Commission will probably devote a part of this money to the work at Utica.

In the federal court at Rochester, N. Y., June 12, the Standard Oil Company was found guilty, by a jury, on an indictment for securing illegal rates for the transportation of oil from Olean, N. Y., to Rutland and other points in Vermont. In the indictment there were 40 counts. Sentence will not be imposed before July 7.

A. W. Perley, Track and Equipment Inspector for the State Railroad Commission of Washington, since April 1, 1907, has inspected 12,261 cars and 1,024 locomotives; in these he found 1,149 cars and 151 engines which had some defect. The law passed in 1897, that footguards be placed in frogs, was only indifferently complied with a year ago, but now it is obeyed.

Judges Kohlsaat, Grosscup and Baker, of the United States Circuit Court, heard arguments at Chicago on June 11 in the case brought by the Chicago & Alton and the Illinois Central to restrain the Interstate Commerce Commission from enforcing the order made by it in the Illinois collieries proceeding, governing the distribution of coal cars. A decision is expected before July 1, when the Commission's order, unless set aside, will become effective.

On Friday last letters from Europe by the steamship "Lusitania," of the Cunard Line, were delivered in New York City by the first morning delivery, the steamer having arrived in the harbor about 2 a. m. This is the first time that mail posted in Europe on Sunday was ever delivered thus early in New York. The "Lusitania" left Queenstown Sunday morning and made the run from Daunt's Rock to Sandy Hook lightship by the long or southerly course, in four days, 20 hours, eight minutes. This time is seven minutes better than the best previous trip, which was made by the "Mauretania" of the same line.

The Montreal Street Railway, which was the first to use street cars with large rear platforms arranged to enable conductors to collect fares before admitting passengers to the cars, is now using on its Lachine suburban line two cars, in which the pay-as-you-enter principle is adapted to cars containing two compartments, one for non-smokers and one for smokers. The entrance to this car is at the middle, and the passenger, after paying, may be admitted to the rear or to the front compartment. The total number of seats is 52. It is said that the pay-as-you-enter rule has, in Montreal, done away with about all the accidents occurring in getting on or off the cars.

The Missouri Supreme Court has rendered a decision holding unconstitutional the state law forbidding railroads to keep telegraphers on duty for more than eight consecutive hours in a day of 24 hours. The decision was rendered in a case against the Missouri Pacific for alleged violation of the law, carried up from Johnson County. It was contended by the road that the act was invald because it interfered with interstate commerce and because it was discriminatory as between two classes of the same kind of labor. The lower court upheld these contentions and its decision was sustained by the supreme court.

The Pennsylvania Railroad has instituted a special campaign of education among its enginemen and firemen to secure good firing. Five assistant road foremen of engines are at work in and near Pittsburgh instructing firemen, and it is the purpose of the railroad to reduce the smoke not only in places where the smoke itself is particularly objectionable, but everywhere, in order to secure economy. It is estimated that the quantity of coal necessary to generate the steam to haul one freight car one mile may be wasted by leaving the safety valve of an engine open one minute. The Pennsylvania last year hauled 1,248,449,300 freight cars one mile. Its coal bill was about $10,000,000, so that a saving of 1 per cent. by more efficient firing will result in a saving of $100,000 annually.

Traffic News.

The Passenger Department of the Pennsylvania Lines West of Pittsburgh has announced reduced rates for the Fourth of July generally throughout the company's lines, the basis being a fare and a half for the round trip, with a minimum rate of $1. Tickets will be sold July 3 and 4, good to return until July 6.

The United Fruit Company has withdrawn its fruit steamers between Jamaica and Charleston, S. C., and proposes to run these boats henceforth to Baltimore. It is said that this change has been made in consequence of an increase in rates on bananas between Charleston and northern cities over the Southern Railway.

The railroads have granted merchants' rates to New York from points in Vermont on the Rutland and the Delaware & Hudson roads, and from points in Massachusetts on the Boston & Albany west of Springfield, August 15-19 and August 29 to September 2, inclusive, with a 15-day return limit. The special fare will be a fare and one-fifth for the round trip, on the certificate plan.

The Pullman Company has recently announced changes in its rates for seats in parlor cars in the states of Michigan and New York. According to some of the newspaper items, the new tariffs show rates higher than the old, but an officer of the company says that the long-standing rate of one-half cent a mile is adhered to. Heretofore rates have been made in even quarters of a dollar, so that some were a little below the mileage rate and some a little above.

The White Star Line, having withdrawn from its New York service a number of freight steamers, some of the grain exporters are complaining that the falling off in export grain traffic through New York is due to the high rates maintained by the trunk line railroads. Export rates are now more favorable by way of Montreal than through any north Atlantic port in the United States. On the other hand, the railroads say that the total volume of exports is now very small, so that the true explanation of the White Star Line's action is that there is no grain to ship.

At a hearing before the Massachusetts State Railroad Commissioners in Boston this week representatives of the express companies doing business in that city declared that all of their business within 50 miles of Boston has been done at a loss for several years past; that the work could not have been done at the rates which have prevailed had it not been for the receipts from long-distance shipments. An officer of the American Express Co. gave figures purporting to show the losses sustained by his company month by month during the past year. The hearing before the commission is on a protest against a 20 per cent. increase in rates which the express companies have announced.

The transcontinental railroads, which had announced that through freight rates to and from Asiatic points would be discontinued on July 1, on account of the requirement made by the Interstate Commerce Commission, that the tariffs of such rates must show the railroad portion separated from the ocean part, have changed the date, and will not disturb existing practice until October 1. The announcements which were made indicated that transpacific freight would be charged for at the same rates as domestic freight; but the importers complained loudly, declaring that it would be necessary to have their goods come through the Suez canal. On ocean ship-

ments the railroads have been receiving, in many cases, rates less than half those received for domestic shipments.

The shipments of anthracite coal from the mines in the month of May amounted to 6,088,116 tons. This is the largest monthly record ever reported, and about 94,000 tons more than for the month of May, 1907. The shipments by the different roads in May were as follows:

	1908.	1907.
Philadelphia & Reading	1,261,555	1,249,133
Lehigh Valley	1,059,978	963,552
Central of New Jersey	874,128	818,256
Delaware, Lackawanna & Western	938,837	924,693
Delaware & Hudson	505,395	593,100
Pennsylvania	569,748	565,668
Erie	629,638	644,730
New York, Ontario & Western	248,837	235,131
Total	6,088,116	5,994,272

The committee on commercial law, appointed by the Commissioners on Uniform State Laws, has issued its third tentative draft of an act to make uniform the law of bills of lading, and railroad men, shippers and others interested in this subject are invited to attend a meeting of the committee which is to be held in Seattle, Wash. (New Washington Hotel), August 20. This committee meeting is preliminary to a meeting of the commissioners at the same place on August 21, 22 and 24. The chairman of the committee on commercial law is Francis B. James, of Cincinnati. This board of commissioners consists of representatives from the several states, appointed by their respective governors. There are usually three from each state. The last conference, which was the seventeenth, was held at Portland, Me., last August. The President of the organization is Amasa M. Eaton, of Providence, R. I. Mr. James' committee will also consider a draft of an act to make uniform the law of certificates of stock, and an invitation has been issued similar to that concerning the bill of lading. Copies of these preliminary drafts can, no doubt, be obtained by writing to Mr. James, whose office is in the Mercantile Library Building, Cincinnati.

At a hearing in Albany, N. Y., last week on the application for a franchise for the proposed Buffalo, Rochester & Eastern Railroad, Messrs. A. H. Smith, Vice-President of the New York Central; C. S. Sims, Vice-President of the Delaware & Hudson; J. C. Stuart, General Manager of the Erie, and William S. Kallman, Second Assistant Freight Traffic Manager of the New York Central, gave some interesting testimony concerning traffic conditions in New York State. Mr. Smith said that it would be impossible for the proposed new road to carry the 8,000,000 tons of freight it figured on. The Central, with its facilities, affiliations and experience was going to be there also. The new road evidently had not figured in its estimated cost of operation the burdens imposed by state legislatures. Mr. Kallman attributed the failure of more lake freight to come to Buffalo not to the lack of rail lines out of that city, as contended by the backers of the proposed new road, but to lately increased opportunities offered by Canadian routes and differentials offered by other ocean ports over New York and Boston. Mr. Sims told how, owing to the failure of the Boston & Maine last year to take freight brought east for New England, he had been compelled to declare an embargo on all freight for New England from the west. This lasted for two weeks. Mr. Stuart said the Erie was doing a single track business out of Buffalo now with a double track line. His road with present facilities could handle 150 per cent. more business than was ever offered it.

INTERSTATE COMMERCE COMMISSION.

Combination Rates.

Marshall Michel Grain Co. v. Missouri Pacific. Opinion by Chairman Knapp.

The complainant shipped two carloads of bran, milled in transit, from Salina, Kan., to Little Rock, Ark., over defendant's direct line through Coffeyville, Kan., and was charged the published through rate which is higher than an alleged combination of a rate on bran over defendant's line to Kansas City, Mo., plus a proportional rate from Kansas City, Mo., to Little Rock, Ark. The complainant claimed that it should have the benefit of the lower alleged combination rate; but the Commission decided that under defendant's tariffs there was no combination on Kansas City less than the through rate, and ordered the complaint dismissed.

Storage Charges at West Fairport, Ohio.

Charles England & Co. v. Baltimore & Ohio. Opinion by Commissioner Harlan.

The shipper is entitled to recover from the carrier $488.61 as reparation on account of unlawful storage and insurance charges at West Fairport, Ohio, on 50,000 bushels of rye, originating at Manitowoc, Wis., and destined for Baltimore, Md.

Differential Against Anthony, Kan., Unjust.

Anthony Wholesale Grocery Co. v. Atchison, Topeka & Santa Fe et al. Opinion by Commissioner Clements.

The differential of 6 cents per 100 lbs. in carloads on rice and sugar from points in Texas and Louisiana against Anthony, Kan., as compared with Wichita, Kan., Hutchinson, Winfield and Arkansas City, is not just and should not exceed 3 cents; and the rates on other commodities and the class rates should be adjusted on approximately the same relative basis.

Ultimate Use Must Not Determine Rates.

Fort Smith Traffic Bureau v. St. Louis & San Francisco and Illinois Central. Opinion by Commissioner Cockrell.

The Commission condemned the concurrent existence of two different rates on the same commodity when the traffic moves over the same route in the same direction, between the same points, and the carriers, by their published tariffs, assume to charge one rate or the other according to the ultimate use to which the commodity is to be put. Tariffs which apply rates upon commodities according to their use are improper. The duty of a common carrier is to transport commodities at its tariff rates and on equal conditions for all.

Wood Pulp Rates from Duluth, Minn., to Rhinelander, Wis.

Rhinelander Paper Co. v. Northern Pacific and Chicago & North-Western. Opinion by Chairman Knapp.

The complaint challenged the reasonableness of 8-cent rate on pulp wood from Duluth, Minn., to Rhinelander, Wis., and questioned the rate adjustment on paper from Rhinelander to points east of the Mississippi river, whereby Rhinelander is charged rates 2 cents in excess of those applying from the Fox river district in Wisconsin. During the proceeding the 8-cent rate on pulp wood was reduced to 6.95 cents. The Commission held that the reduced rate on pulp wood is not excessive, and that the rate adjustment on paper is not unlawful.

Rates on Lumber from Chicago to the Pacific Coast.

George D. Burgess et al. v. the Transcontinental Freight Bureau, et al. Opinion by Commissioner Prouty.

Rates upon softwood lumber from Pacific coast producing points may properly be lower to eastern destinations than rates upon hardwood lumber from such eastern destinations to Pacific coast points. A rate of 85 cents from Chicago and Chicago points to Pacific coast points, upon hardwood lumber, is excessive; the rate should not exceed 75 cents. Where a shipper has paid an excessive rate he may recover as reparation the difference between the rate paid and what would have been a reasonable rate at the time, even though he may not ultimately be damaged by the payment of the higher rate; but reparation was allowed in this case only from the date of the filing of the complaint.

Demurrage Charges.

MacBride Coal & Coke Co. v. Chicago, St. Paul, Minneapolis & Omaha. Opinion by Commissioner Lane.

The Commission may afford relief from the imposition of demurrage charges upon a showing that the complainant has been subjected either to unjust discrimination or to the payment of unreasonable charges, but the record in this case does

not show unjust discrimination or unreasonable charges, the complaint therefore was dismissed. If complainant contended that demurrage charges exacted by defendant did not constitute a lawful lien upon the property, and that defendant's action amounted to an unlawful conversion, its complaint should have been brought before some court of competent jurisdiction and not before this Commission, whose function is to enforce the provisions of the act to regulate commerce and kindred laws.

Rates on Lumber from Memphis, Tenn., to New Orleans, La.

J. W. Thompson Lumber Co. and 13 other complainants v. Illinois Central, Yazoo & Mississippi Valley, and St. Louis, Iron Mountain & Southern. Opinion by Commissioner Lane.

The complaint of these lumber shippers at Memphis, Tenn., alleged that the rate of 12 cents per 100 lbs. on hardwood lumber (except gum) from Memphis to New Orleans, La., is unreasonable and unjust and claimed reparation. The rate on such lumber between said points had been for 15 years prior to February 2, 1903, 10 cents per 100 lbs., but on that date the rate was advanced two cents. The Commission held that the 12-cent rate was unreasonable, and ordered that a rate not exceeding 10 cents per 100 lbs. be put in effect; but the complaint as to the St. Louis, Iron Mountain & Southern was dismissed, and the matter of reparation was reserved for future consideration.

Higher Rate for Shorter Distance Upheld.

Randolph Lumber Co. v. Seaboard Air Line et al. Opinion by Commissioner Prouty.

The Norfolk & Western reaches from Petersburg, Va., certain Ohio territory, and the same territory is reached by the Chesapeake & Ohio from Richmond, Va., over its own line and that of its connections. The Seaboard Air Line runs from Petersburg to Richmond, Chester, Va., being located upon that line, midway between these two cities. Rates on lumber from Petersburg, Va., to these Ohio points are the same and have been long established. The Atlantic Coast Line transports lumber from Petersburg, through Chester via Richmond, to these Ohio destinations, in connection with the Chesapeake & Ohio at the rate prevailing from Petersburg; but it applies a higher rate to the transportation of lumber taken up at Chester.

The Commission held that in making the higher rate from Chester the carriers did not violate sections 3 or 4, since competitive conditions at Petersburg not obtaining at Chester forced the rate from Petersburg. The rate from Chester, which is a joint through rate established by the Seaboard Air Line and the Chesapeake & Ohio, should not, however, exceed the rate from Richmond by the full amount of the local from Chester to Richmond.

Carriers Must Abide by Published Tariffs.

La Salle & Bureau County Railroad v. Chicago & North-Western. Opinion by Commissioner Clements.

No order can be made requiring defendant to publish in its tariffs any allowance for transportation of freight by complainant from and to La Salle Junction, Ill., or to pay complainant allowances for specific service performed between certain dates. When rates are filed and published, carriers must abide thereby. No allowances of any kind not specified in tariffs can lawfully be paid. The power of the Commission to award reparation does not extend to the division of rates between connecting carriers. Claims *ex contractu* are not cognizable by the Commission. It cannot therefore order the payment of money for services performed nor for a debt due one carrier from another on acount of joint rates for a joint service. Such claims rest upon contract, expressed or implied. The jurisdiction of the Commission in this respect is limited to reparation for damages caused by violation of some provision of the act to regulate commerce.

Complainant's application for leave to amend its complaint, so as to make it cover establishment of through routes and joint rates from and to La Salle over its line to and from all points over defendant's line, is denied. The Commission does not favor a practice of ingrafting an application for through routes and joint rates to a claim for reparation upon the basis of that here presented.

Effect of Advantages of Location on Rates.

Payne-Gardner Co. v. Louisville & Nashville. Opinion by Chairman Knapp.

The petition questions the reasonableness of the rate of 31 cents per 100 lbs. charged by defendant for transportation of sugar in carloads from New Orleans, La., to Gallatin, Tenn. It says that this rate discriminates against dealers at Gallatin in favor of shippers at Nashville, Tenn., and Bowling Green, Ky., and Louisville. The Commission held that the present rate of 31 cents is unreasonable, and that the rate should not exceed 25 cents. Reparation was awarded. Advantage of location, such as proximity to a navigable stream or strong competition between carriers, naturally results in lower rates to a town so situated, and it is not the province of the Commission to disturb the resulting rate relations unless the discrepancy is so great as to effect an unjust discrimination against the non-competitive point; but the mere fact that a given town has been recognized as a trade center, and is enabled by its more favorable rate adjustment to distribute in a certain territory, cannot justify the continuance of relative rates which result in undue preference. The dealer in a small town is entitled to a reasonable adjustment which will enable him to compete with dealers at trade centers enjoying the benefit of competitive rates.

Special Rates to Open New Markets.

New Albany Furniture Co. v. Mobile, Jackson & Kansas City, and same complainant v. St. Louis & San Francisco et al. Opinion by Commissioner Clark.

The complainant finding that competitive manufacturing points in similar territory had rate adjustments which gave them an advantage over complainant in nearly every available market, sought a rate adjustment with defendants. After a year of negotiations, rates were so adjusted and complainant changed its patterns and methods at considerable expense in order to manufacture for the eastern market so opened to it. Defendants were unable to agree upon satisfactory divisions of the rates so established, and on that account as well as because of threatened reduction of rates from competitive points, increased the rates from complainant's factory one year after they were established. The Commission held that the rates were low before the increase, but having been established after prolonged negotiations especially for the purpose of permitting complainant to reach a particular market, and in preference to making a readjustment in some other direction or territory, defendants may not by an arbitrary advance in those rates destroy complainant's business, there being no evidence that the rates advanced were less than the cost of service. Reparation was awarded.

Banana Rates from New Orleans, La., to Kansas City, Mo.

Topeka Banana Dealers' Association v. St. Louis & San Francisco et al., and Missouri Valley Banana Dealers' Association v. St. Louis & San Francisco et al., and of the Missouri & Kansas Shippers' Association v. St. Louis & San Francisco et al. Opinion by Commissioner Lane.

The defendants' rule of assessing charges on the weight of bananas at point of origin instead of on the weight of the fruit at destination is not unjust. Fixing a minimum weight at 20,000 lbs. on shipments of bananas from New Orleans, La., and Mobile, Ala., to points west of the Mississippi river, while assessing a minimum weight of 18,000 lbs. to Chicago and points east of the river, does not result in undue discrimination, as it appears that such difference in minima is made to meet competition through Baltimore, Md., and that cars of bananas from New Orleans and Mobile are usually loaded from 2,000 to 4,000 lbs. in excess of the 20,000 lbs. minimum.

The complaint that a lesser rate is charged on bananas from New Orleans to Burlington, Iowa, than to Kansas City, Mo., an intermediate point, is not sustained, as the joint rate quoted via Kansas City is a paper rate on which the traffic does not move, the bananas destined for Burlington moving

through St. Louis. Defendants' banana rates from Mobile and New Orleans to Kansas City and adjacent points are not found to be unreasonable.

No Discrimination Against Nashville, Tenn.

Phillips-Trawick-James Co. et al. v. Southern Pacific et al. Opinion by Commissioner Clark.

The complaint attacks the reasonableness of rates on canned goods and dried fruit from Pacific coast terminals to Nashville, Tenn., as compared with other points in Tennessee, Ohio, and Kentucky; but the Commission held that the rates complained of are not unreasonable *per se* and that they do not unjustly discriminate against Nashville in favor of the other points named. The traffic involved in the complaint is hauled through Nashville to farther distant points at lower rates than are charged at Nashville by only one defendant, and by that defendant to only four of the points mentioned in the complaint. The controlling conditions of competition at each of those four points are found to be such as to relieve defendant from the charge of violating the long and short haul section of the act to regulate commerce.

STATE COMMISSIONS.

Indiana. Rate Reductions Withheld Pending Court Decision.

An inquiry concerning class rates. Opinion by Commissioner McAdams.

In May, 1907, the Commission asked carriers operating out of Indianapolis to give their views on a revision of intrastate rates. The following facts were brought out by the inquiry: Between 1870 and 1907, population increased 52 per cent. and the value of taxable property within about 80 miles of Indianapolis increased 133 per cent. Between 1894 and 1907, the average tonnage per loaded car-mile on different lines operating in this territory increased from 50 to 300 per cent. The train load more than doubled on every line during this period. Between 1894 and 1900, the operating ratio decreased, but since 1900 it has increased, and in 1907 was higher than in 1894. Rates per ton per mile decreased from 1894 to 1900, and since then have increased, but they are now less than they were in 1894. The Pittsburgh, Chicago, Cincinnati & St. Louis is an exception to this, its rates being higher in 1907 than in 1894. Net operating revenues and freight earnings per mile of road have each increased about 100 per cent. since 1894. Comparisons were given of the rates, grades, curvatures, train tonnages and valuations per mile of the various lines from and to Indianapolis. Commenting on these showings, the Commission said: "Almost every principle or theory entering into the making of rates can be refuted by the conditions and practices shown in the record in this case." Traffic officers who testified could not explain or justify the lack of uniformity of rates. It was shown that since the panic several lines had not been able to earn enough to pay operating expenses, and certain recent federal and state laws have added to the expenses of operation and maintenance. The Commission decided not to issue any new orders at this time, withholding action until the validity of an order by the Commission in the case of Schnull & Co. vs. Vandalia, requiring the railroad to reduce certain of its class rates on the St. Louis division, had been determined by the courts. However, the Commission may, if it desires, resume the inquiry and issue orders previous to the termination of the Vandalia case.

Proposed Advance in Cream Rates.

Commissioner C. A. Prouty, of the Interstate Commerce Commission, took testimony at Chicago on June 10, 11, 12 and 13 in the proceeding brought by the Beatrice Creamery Co. of Iowa, the Blue Valley Creamery Co. of St. Joseph, Mo., and the Blue Valley Creamery Co. of Sioux City, Ia., attacking the reasonableness of proposed advances by certain of the Chicago lines in their rates on cream. From the testimony it appears that the proceeding has developed into a contest between the three creamery companies mentioned, composing the so-called "creamery trust," on the one hand, and the railroads and the small creamery concerns, on the other hand. The lines running from Illinois, Iowa, Nebraska, Minnesota and Wisconsin to Chicago gave notice of advances in their rates on cream to take effect September 1. The Beatrice Creamery Co. and others secured an injunction from Judge Kohlsaat of the United States Circuit Court to prevent the railroads from collecting the higher charges. Counsel for the railroads stated in the hearing at Chicago that the reason for the advance was a change in conditions. They said that the rates to Chicago on cream and milk that had been in effect for many years were meant to be, and originally were, applied only on milk and cream for domestic use. Within the last few years the creamery business has developed greatly and the complainants in this case were seeking to monopolize it. It was stated that they had been shipping butter fat from their collecting stations to their so-called "concentrating centers" at the rate previously made for cream. Butter fat, it was contended, being a much more concentrated and valuable substance than milk or cream, should pay a higher rate; and it was on this commodity, rather than on cream for domestic use, that the higher rate was meant to apply. The use of the old rate for the shipment of butter fat put the local creameries at a disadvantage, as they make butter and ship it at the higher butter rate to the large markets. John Barnes, formerly chairman of the Railroad Commission of Wisconsin, appeared for the small creamery concerns of Wisconsin, and he and counsel for the railroads introduced testimony to sustain the contentions above summarized. On the other hand, counsel and witnesses for the large creamery concerns contended that there was no substantial difference between cream and butter fat, and that the advance in the rate made by the railroads was a discrimination against them. The testimony tended to show that there were formerly about 400 or 500 independent creameries in Nebraska and that the competition of the larger concerns had reduced this number to about 20. It was also shown that there were 1,600 cheese factories and 1,200 cream stations in Wisconsin which are directly interested in this proceeding. Mr. Barnes and witnesses he called contended that the proposed higher rates were not discriminatory as against the large creamery companies, but that, on the other hand, the rates previously in effect were discriminatory as against the smaller concerns and were helping to destroy them.

Western Live Stock Movement.

According to the *Monthly Summary of Commerce and Finance*, the receipts of live stock at seven western markets in April were as shown below:

Markets.	Receipts—Cars					
	Month of April,			4 months ending April		
	1906.	1907.	1908.	1906.	1907.	1908.
Chicago	22,014	25,391	19,164	100,761	102,867	102,478
Kansas City	9,890	11,612	8,904	44,186	46,430	45,055
Omaha	6,460	8,372	5,508	28,285	31,335	28,758
St. Louis	6,332	7,011	6,498	31,367	31,133	30,833
St. Joseph	4,002	5,049	3,327	18,068	19,789	19,320
St. Paul	1,642	1,621	1,711	7,540	6,767	9,040
Sioux City	2,529	2,982	1,876	10,718	12,409	11,938
Total, 7 cities.	52,869	62,038	46,988	240,925	250,730	248,422

Shipments during the same period were as follows:

Markets.	Shipments—Cars					
	Month of April,			4 months ending April		
	1906.	1907.	1908.	1906.	1907.	1908.
Chicago	7,630	8,392	7,807	35,333	33,843	37,094
Kansas City	2,814	2,879	2,691	12,780	12,744	11,793
Omaha	991	1,366	1,536	4,507	4,863	5,519
St. Louis	2,260	2,354	2,739	12,298	10,944	11,650
St. Joseph	709	690	687	2,866	3,027	3,380
St. Paul	521	445	881	2,321	1,775	3,006
Sioux City	779	842	786	3,039	3,566	3,205
Total, 7 cities.	15,704	16,968	17,127	73,144	70,762	75,647

Street Railway Association of the State of New York.

This association will hold its twenty-sixth annual convention at Hotel Clifton, Niagara Falls, Ont., on June 30 and July 1, 1908. There will be papers on various electric traction subjects and a general discussion of operating problems.

American Association of Traveling Passenger Agents.

This association will hold its thirty-sixth annual convention in Seattle, Wash., on September 14 and 15, 1908.

REPORT OF REVENUES AND EXPENSES OF RAILROADS FOR MONTH OF APRIL, 1908.

Name of road.	Mileage operated at end of month.	Operating revenues: Revenue, Freight.	Revenue, Passenger.	All other revenue from transportation.	Revenue, operations other than transportation.	Total operat'g revenues.	Operating expenses: Maintenance Way and structures.	Maintenance Of equipment.	Expenses Traffic.	Expenses Transportation.	Expenses General.	Total operating expenses.	Net operating revenues (or deficit).	Taxes.	Operating income (or loss).
Alabama Great Southern	309	$167,746	$59,427	$22,523	$2,856	$252,552	$31,282	$60,667	$6,595	$98,151	$6,163	$202,858	$49,694	$11,430	$38,264
Ann Arbor	301	95,345	31,907	6,882	632	134,766	13,446	23,548	2,775	57,302	3,130	100,201	34,565	11,667	22,898
Atlanta, Birmingham & Atlantic	571	71,645	25,759	5,054	1,556	104,014	16,390	15,874	4,049	32,805	3,692	72,810	31,204	4,000	27,204
Chicago & Erie	270	239,436	59,938	23,919	621	323,914	19,782	39,242	10,509	163,160	7,268	239,961	83,953	12,304	71,649
Chicago, Cincinnati & Louisville	285	50,765	16,799	4,373	196	72,133	15,237	19,999	7,193	41,088	4,188	87,705	15,572*	3,250	†18,822
Chicago Great Western	818	446,038	128,894	43,060	5,787	623,779	84,898	123,274	33,855	287,896	26,312	556,235	67,544	17,000	50,544
Chicago, Milwaukee & St. Paul	7,506	2,980,399	870,857	340,429	32,944	4,224,629	607,145	640,659	101,654	1,687,025	71,364	3,107,847	1,116,782	209,702	907,080
Chicago, Rock Island & Gulf	472	158,298	56,436	11,278	616	226,628	38,047	17,353	5,862	96,312	6,828	164,402	62,226	7,710	54,516
Cincinnati, Hamilton & Dayton	1,038	355,731	118,338	43,855	2,147	520,071	71,868	127,033	20,889	259,221	19,388	498,399	21,672	25,027	†3,355
Cincinnati, New Orleans & Texas Pac	338	471,278	104,591	33,915	1,353	611,137	47,105	123,517	15,383	220,215	14,312	420,532	190,605	18,000	172,605
Colorado Midland	338	105,881	24,071	14,065	303	144,320	19,881	19,567	9,388	63,770	4,773	117,379	26,941	8,400	18,541
Duluth, South Shore & Atlantic	593	120,090	64,767	11,542	1,530	197,929	30,843	23,216	5,545	76,497	5,619	141,720	56,209	15,500	40,709
Galveston, Harrisburg & San Antonio	1,343	539,606	181,015	30,695	5,116	756,432	91,734	81,076	18,671	350,050	23,819	565,350	191,082	31,695	159,387
Hocking Valley	347	169,815	58,563	17,717	500	246,595	48,174	64,665	6,971	102,518	11,648	233,976	12,619	16,465	†3,846
International & Great Northern	1,160	337,290	118,589	36,821	3,363	496,063	109,297	121,402	14,071	245,591	15,641	506,002	9,939*	20,000	†29,939
Long Island	392	235,854	388,526	145,338	15,903	785,621	88,363	107,146	12,207	357,851	23,100	588,667	196,954	21,713	175,241
Louisiana Ry. & Nav. Co.	344	65,007	12,540	3,494	7,639	88,680	15,263	8,847	2,818	33,982	2,741	63,651	25,029	4,066	20,963
Mason City & Fort Dodge	386	101,560	31,579	8,713	2,368	144,220	22,777	17,017	1,911	60,973	570	103,248	40,972	6,000	34,972
Morgan's La. & Tex. R.R. & S.S. Co.	351	217,942	81,973	20,797	2,340	323,052	39,784	32,791	7,667	133,134	10,763	224,139	98,913	14,861	84,052
New York, New Haven & Hartford	2,006	2,036,575	1,761,321	268,990	82,803	4,149,689	422,666	455,728	27,582	1,750,598	94,832	2,751,406	1,398,283	250,000	1,148,283
Norfolk & Southern	582	128,286	42,849	11,113	1,695	183,943	26,711	31,052	6,158	76,486	11,712	152,119	31,824	7,700	24,124
Northwestern Pacific	368	67,803	127,271	17,107	3,505	215,686	45,341	40,607	2,160	84,748	5,981	178,837	36,849	9,742	27,107
Peoria & Eastern	352	135,833	44,369	15,148	1,855	197,205	36,606	26,955	4,845	99,045	4,298	171,749	25,456	3,656	21,800
Quincy, Omaha & Kansas City	262	31,035	13,543	3,797	437	48,812	17,404	6,717	1,553	22,035	2,497	50,206	1,394*	2,250	†3,644
Rutland	468	120,370	65,898	20,369	5,527	212,164	29,226	32,467	5,082	83,291	4,712	154,778	57,386	6,428	50,958
St. Joseph & Grand Island	312	89,014	22,402	6,433	2,368	120,217	13,772	6,253	5,468	36,020	4,246	65,759	54,458	6,772	47,686
San Pedro, Los Angeles & Salt Lake	1,099	366,056	223,202	26,700	5,443	621,401	80,954	86,886	26,402	247,162	13,006	454,412	166,989	21,345	145,644
Seaboard Air Line	2,611	863,432	306,653	91,619	45,068	1,306,772	177,376	199,638	45,456	520,930	50,565	993,965	312,807	52,417	260,390
Southern Indiana	351	60,889	14,594	2,602	9,845	87,930	23,568	11,560	1,762	31,670	6,312	74,872	13,058	6,928	6,130
Texas & New Orleans	450	180,202	59,126	13,487	2,599	255,414	35,016	40,459	4,745	139,063	7,400	226,683	28,731	12,485	16,246
Wabash	2,515	1,213,479	448,212	142,250	10,578	1,814,719	256,815	300,824	67,653	772,706	55,029	1,453,027	361,692	63,255	298,437
West Jersey & Seashore	374	122,777	244,740	39,594	3,459	410,570	66,266	41,889	12,319	185,221	7,714	313,409	97,161	17,112	80,049
Wheeling & Lake Erie	442	183,420	34,320	17,388	1,306	236,434	41,795	47,758	6,300	115,596	12,557	224,007	12,427	18,904	†6,477
Wisconsin, Minnesota & Pacific	271	29,995	12,086	3,300	580	45,961	13,522	5,114	278	19,937	213	39,064	6,897	1,838	5,059

REPORT OF REVENUES AND EXPENSES OF RAILROADS FOR TEN MONTHS OF FISCAL YEAR 1908.

Name of road.	Mileage operated at end of period.	Operating revenues: Revenue, Freight.	Revenue, Passenger.	All other revenue from transportation.	Revenue, operations other than transportation.	Total operat'g revenues.	Operating expenses: Maintenance Way and structures.	Maintenance Of equipment.	Expenses Traffic.	Expenses Transportation.	Expenses General.	Total operating expenses.	Net operating revenues (or deficit).	Taxes.	Operating income (or loss).
Alabama Great Southern	309	$1,923,321	$844,282	$236,381	$4,466	$3,008,450	$421,632	$723,531	$74,662	$1,135,678	$71,288	$2,426,791	$581,659	$109,045	$472,614
Ann Arbor	301	1,118,363	388,236	87,411	10,434	1,604,444	188,413	305,949	28,399	664,147	27,251	1,214,159	390,285	116,667	273,618
Atlanta, Birmingham & Atlantic	571	952,300	321,080	47,531	19,671	1,340,582	218,637	206,809	39,048	473,759	48,633	986,886	353,696	37,001	316,695
Chicago & Erie	270	2,531,531	706,465	278,817	20,413	3,537,226	470,302	856,353	111,381	1,707,002	77,928	3,222,966	314,260	123,033	191,227
Chicago, Cincinnati & Louisville	285	614,720	211,740	42,919	5,268	874,647	169,163	220,780	72,242	450,354	40,284	952,833	78,186*	33,642	†111,828
Chicago Great Western	818	4,697,056	1,604,933	491,813	45,675	6,839,459	775,861	1,173,705	355,767	3,138,881	267,637	5,711,851	1,127,608	170,000	957,608
Chicago, Milwaukee & St. Paul	7,506	34,723,529	9,865,793	3,482,270	342,629	48,414,221	5,336,586	6,024,908	1,049,186	18,185,567	690,409	31,286,656	17,127,565	1,909,846	15,217,719
Chicago, Rock Island & Gulf	472	1,965,443	600,272	111,817	11,319	2,688,851	388,795	261,228	68,065	1,047,089	72,151	1,837,328	851,523	66,427	785,096
Cincinnati, Hamilton & Dayton	1,038	4,787,360	1,458,823	440,425	80,164	6,766,772	921,604	1,460,295	211,869	3,050,477	186,264	5,830,509	936,263	259,735	676,528
Cincinnati, New Orleans & Texas Pac	338	5,042,189	1,325,058	301,844	10,208	6,679,299	556,973	1,689,435	167,041	2,561,695	150,826	5,125,970	1,553,329	180,000	1,373,329
Colorado Midland	338	1,355,182	301,316	207,972	6,887	1,871,357	286,042	242,812	95,936	759,869	51,438	1,436,097	435,260	86,033	349,227
Duluth, South Shore & Atlantic	593	1,573,769	821,318	121,915	18,008	2,535,010	461,634	301,330	72,380	989,371	59,962	1,884,677	650,333	160,492	489,841
Galveston, Harrisburg & San Antonio	1,343	6,764,563	1,946,534	315,352	47,045	9,073,494	1,164,955	1,404,570	233,636	4,223,449	240,800	7,267,410	1,806,084	388,977	1,417,107
Hocking Valley	347	4,200,790	709,160	156,449	23,137	5,089,536	673,185	1,155,439	70,475	2,866,640	171,233	3,565,754	1,523,782	190,895	1,332,887
International & Great Northern	1,160	4,040,313	1,423,395	386,245	42,092	5,892,045	962,848	1,269,806	156,719	4,221,758	184,865	5,507,763	384,282	230,000	154,282
Long Island	392	2,118,206	4,132,604	1,658,880	165,430	8,075,120	1,100,690	1,223,528	145,672	2,866,640	171,233	6,795,996	1,279,124	217,136	1,061,988
Louisiana Ry. & Nav. Co.	344	631,195	154,816	38,656	16,970	841,637	252,063	159,282	23,345	382,605	29,476	846,771	5,134*	31,062	†36,196
Mason City & Fort Dodge	386	1,066,074	349,858	72,761	20,358	1,509,051	138,367	186,044	17,842	633,088	5,780	981,121	527,930	60,000	467,930
Morgan's La. & Tex. R.R. & S.S. Co.	351	3,073,175	916,021	224,030	34,758	4,247,984	723,908	605,155	86,936	1,728,153	111,768	3,255,920	992,064	154,423	837,641
New York, New Haven & Hartford	2,006	21,167,481	19,406,638	2,894,836	1,091,362	44,560,317	4,478,094	6,593,512	256,879	19,574,107	1,139,696	32,042,288	12,518,029	2,692,000	9,826,029
Norfolk & Southern	582	1,170,779	566,476	86,820	17,304	1,841,379	261,387	303,028	66,629	736,464	111,945	1,479,454	361,925	65,000	296,925
Northwestern Pacific	368	982,965	1,346,534	173,554	41,666	2,544,719	585,949	428,892	18,083	947,129	75,084	2,055,137	489,582	92,121	397,461
Peoria & Eastern	352	1,689,603	557,488	166,736	14,851	2,428,678	329,494	356,213	47,007	990,216	44,990	1,767,920	660,758	77,966	582,792
Quincy, Omaha & Kansas City	262	411,218	153,327	41,060	8,187	613,792	171,418	115,357	16,797	276,266	30,222	610,060	3,732	23,543	†19,811
Rutland	468	1,355,557	843,437	210,097	46,212	2,455,303	387,319	399,555	59,880	1,006,248	55,921	1,908,923	546,380	86,910	459,470
St. Joseph & Grand Island	312	1,000,300	272,688	64,961	24,308	1,362,257	169,473	138,877	52,289	408,987	38,247	807,873	554,384	67,443	486,941
San Pedro, Los Angeles & Salt Lake	1,099	3,744,276	2,230,874	256,898	77,135	6,309,183	1,389,839	967,991	233,917	2,485,845	146,317	5,223,909	1,085,274	205,965	879,309
Seaboard Air Line	2,611	8,900,767	3,244,582	797,780	372,576	13,315,705	1,853,096	2,045,870	458,280	5,356,856	408,749	10,122,851	3,192,854	495,667	2,697,187
Southern Indiana	351	931,367	155,568	24,833	278,152	1,389,920	207,662	211,470	16,921	389,862	56,166	882,081	507,839	69,285	438,554
Texas & New Orleans	450	2,314,306	737,933	146,450	26,901	3,225,590	498,770	612,071	56,557	1,362,656	70,122	2,600,176	625,414	142,354	483,060
Wabash	2,515	14,579,856	5,487,323	1,550,321	123,569	21,741,069	2,231,007	3,680,902	731,148	8,709,997	549,727	15,902,781	5,838,288	600,960	†5,237,328
West Jersey & Seashore	374	1,343,083	2,789,084	465,751	29,966	4,627,884	724,470	574,328	119,040	2,012,685	82,407	3,512,930	1,114,954	171,124	943,830
Wheeling & Lake Erie	442	3,811,492	409,536	244,075	156,540	4,621,643	556,372	984,115	68,013	1,976,899	107,295	3,692,694	928,949	211,615	717,334
Wisconsin, Minnesota & Pacific	271	352,457	125,406	34,767	6,358	518,988	106,655	41,862	2,949	216,663	988	369,117	149,871	20,748	129,123

* Deficit. † Loss.

Receipts of Grain and Flour at Interior Markets.

The following tables, taken from the *Monthly Summary of Commerce and Finance*, published by the Department of Commerce and Labor, show the total receipts of wheat, corn, oats, barley, rye and flaxseed, and also the total receipts of flour, at interior points during April and the four months ending with April, 1908, 1907 and 1906. Of the grains, the largest receipts for the four months are those of corn, 81,566,323 bushels, with oats (70,338,786 bushels) second. For the month of April the receipts of oats lead, as is often the case.

Markets.	Receipts, month of April			Receipts, 4 months ending April		
	1906.	1907.	1908.	1906.	1907.	1908.
Total Grain:	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
Chicago	12,129,692	19,945,858	16,089,137	63,598,355	86,390,499	77,275,459
Cincinnati	1,171,895	2,303,186	1,555,026	6,764,424	6,693,183	6,418,043
Cleveland	1,052,449	1,112,653	791,712	6,258,391	4,403,450	4,890,697
Detroit	837,247	1,003,003	383,938	4,932,894	3,208,065	2,411,422
Duluth	1,997,398	7,144,347	994,293	10,679,722	14,430,454	7,705,041
Indianapolis	763,200	1,562,350	1,022,900	3,155,825	4,197,250	7,157,500
Kansas City	2,588,000	4,198,000	2,151,000	15,249,000	16,495,000	12,132,200
Little Rock	432,000	508,000	455,000	2,082,000	2,116,000	2,290,000
Louisville	2,092,374	2,152,575	1,547,210	7,995,516	7,873,249	5,891,875
Milwaukee	1,793,720	3,399,200	2,179,300	13,388,420	15,875,000	11,728,200
Minneapolis	7,518,230	11,888,600	5,722,190	42,602,940	45,096,500	36,481,860
Omaha	2,060,800	2,608,500	2,166,300	13,199,200	15,607,300	11,604,500
Peoria	4,105,600	2,180,700	2,562,600	13,096,900	9,965,400	12,425,100
St. Louis	5,454,032	7,247,678	4,572,936	24,272,890	31,206,139	24,021,829
Toledo	771,700	1,060,500	695,200	3,767,340	5,401,400	3,883,300
Total, 15 cities	44,768,837	68,225,150	42,889,642	231,043,817	268,959,389	226,317,026
Flour:	Barrels.	Barrels.	Barrels.	Barrels.	Barrels.	Barrels.
Chicago	793,637	946,484	763,870	3,212,966	3,493,237	3,350,461
Cincinnati	124,046	158,096	119,558	556,828	527,794	483,886
Cleveland	48,190	44,460	48,910	182,510	173,960	181,370
Detroit	20,200	11,800	12,800	98,200	40,400	59,900
Duluth	163,400	112,000	135,400	210,300	174,500	162,400
Indianapolis	28,990	29,740	22,470	87,933	101,203	247,850
Kansas City	.....	20,000	7,000	.....	78,800	23,750
Little Rock	8,100	7,950	7,200	33,150	30,600	31,050
Louisville	15,711	16,931	15,623	62,358	68,581	61,406
Milwaukee	235,250	239,600	174,675	680,325	672,075	781,625
Minneapolis	19,693	22,613	18,304	98,213	80,660	71,309
Peoria	65,800	83,100	83,650	310,070	339,300	371,600
St. Louis	160,435	247,725	164,785	724,085	972,380	794,975
Total, 13 cities	1,683,452	1,940,499	1,574,245	6,256,938	6,753,490	6,621,602

Plain Talk from W. B. Biddle.

Statements issued by E. J. McVann, Secretary of the Omaha Grain Exchange, and J. M. Guild, Commissioner of the Commercial Club of Omaha, regarding the alleged "unfriendly attitude" of the Rock Island-Frisco System toward the Omaha grain market, have led W. B. Biddle, Third Vice-President of the Rock Island-Frisco Lines, to make public a statement reviewing the situation at Omaha and defending the attitude of his companies. The attitude of the business interests of Omaha is regarded by railroad officers as amounting to a boycott of the Rock Island-Frisco System. Mr. Biddle says:

In May, 1905, A. S. Dodge, then Vice-President of the St. Louis & San Francisco, acting on a complaint from the Kansas City Board of Trade, prepared to reduce the grain rates from certain points in Northern Kansas and Southern Nebraska via Kansas City to Memphis and points in the Southeast. All the other lines objecting to such an adjustment, and believing that it would result in a demoralization of grain rates, I used my influence with Colonel Dodge to have him refrain from taking such action.

In June, 1906, the Kansas City grain interests again made complaint of the rate adjustment, and being then in charge of St. Louis & San Francisco traffic, as well as that of the Rock Island, I gave personal consideration to the question, and becoming satisfied that the complaint was well-founded, prepared a reduced basis of grain rates from certain Nebraska and Kansas territory via Kansas City to Memphis and the Southeast.

This was not as low as Kansas City demanded but was such as commended itself to our judgment as being fair. I then took the question up with other interested lines and explained the situation to them and received assurances from them that if such an arrangement was put in effect that they would accept it. This adjustment did not in any case place Omaha at a disadvantage, and the Omaha grain people do not claim that it did. They do claim that it removed from Omaha an advantage that it had had, and to which it was entitled.

The adjustment put into effect was to make from these Kansas and Nebraska points, direct, via Kansas City, for a much shorter haul, to certain destinations in the Southeast, the same rates precisely as prevail through Omaha, with the privilege of the Omaha market, for a much longer haul. We became satisfied that, if the reasonable complaint of Kansas City was not recognized, a complaint would be made to the Interstate Commerce Commission, and that in all probability we should be ordered to make as great or greater reductions than we voluntarily accorded.

While this controversy was confined to the grain interests at Omaha, the Omaha Commercial Club, representing all classes of business, at a meeting held on July 18, 1906, adopted resolutions which were sent to all the club's subscribers, recommending that traffic be diverted from the Rock Island and given to its competitors.

On July 24 the club issued another circular asking every loyal citizen of Omaha to see to it that the railroads friendly to Omaha were given all competitive freight, and that the railroads friendly to Omaha be given all the passenger traffic; and stating that the Rock Island was not friendly to Omaha. Officials of the Rock Island visited Omaha and interviewed members of the exchange and prominent merchants repeatedly, endeavored to explain what had been done and the reasons for it. They were repeatedly told that it did not make any difference whether the grain men were right or not; that the entire business community of Omaha intended to stand together until the Rock Island road was forced to do what the grain people demanded. On July 30 another circular of similar purport was issued.

Repeated attempts have been made to straighten the situation out. The Rock Island has offered to leave the entire question to a Board of Arbitration, consisting of Mr. E. J. McVann, the Secretary of the Omaha Grain Exchange; Mr. H. G. Wilson, Commissioner of the Kansas City Transportation Bureau, the two contending parties so far as the rate adjustment is concerned, together with Mr. E. B. Boyd, then Commissioner of the Chicago Grain Exchange, a disinterested party, as a Board of Arbitrators, agreeing in advance to put into effect any basis of rates that these three gentlemen could agree upon, the only condition being that in making a readjustment of rates it should be done in such a way as not to unnecessarily reduce the revenues of the carriers, the idea being that advances might be made in some directions to offset any reductions that might be necessary.

The Rock Island road has repeatedly offered to agree upon a statement of facts covering the controversy and leave the entire question to the decision of the Interstate Commerce Commission, agreeing in advance to abide by its judgment. None of these propositions have met with favor, the only settlement that the Omaha people would accept being that of absolute surrender on the part of the Rock Island to their views.

On May 11, 1908, the Commercial Club issued another circular advising its members that there had been no change whatever in the unfriendly attitude of the Rock Island-Frisco systems toward the Omaha Grain Exchange; thanking the members and the people of Omaha for the loyal support they had given them in punishing the Rock Island road and urging a continuance of this policy.

During all this period, extending over nearly two years, questions have repeatedly arisen involving the interests of Omaha so far as rate adjustment is concerned, and the Rock Island Railroad has never sought in any way to retaliate for the treatment received at Omaha, giving the same considera-

tion to propositions in which Omaha was interested as if this controversy had never arisen.

Comparison of Car-Service Operations.

A convenient index to the traffic activities of the country is found in the comparative figures of cars handled by the various car-service associations. Thirty-six different associations report monthly the number of cars handled in their respective territories. Only in a very rough way, however, do these figures indicate the changes in volume of traffic, inasmuch as they do not, in some cases, include more than one-third of the cars actually handled at a given traffic center, and the territory under control of an association may be extended or contracted from time to time. The figures are given, nevertheless, as a convenient general gage of increase or decrease of traffic by rail, assuming that they are made up on substantially the same basis from year to year.

Comparative Statement of Cars Handled by Car-Service Associations During April and Four Months ending April, 1906-1908.

[Compiled from monthly car-service association reports.]

Name of Assn.	Cars — April			Cars — Four Months		
	1906.	1907.	1908.	1906.	1907.	1908.
Alabama..	58,747	71,241	46,973	263,742	288,201	195,585
Balt.-Wsh.	58,677	67,480	53,492	234,224	233,692	187,235
Bt. Trml.	11,777	11,522	10,146	47,513	44,672	27,605
Ct. (N.Y.)	47,472	62,337	64,027	207,451	240,967	238,930
Ct. (St.L.)	65,317	82,209	54,686	283,182	307,969	234,630
Chicago ..	168,614	190,307	156,629	730,529	754,904	619,460
Cincinnati	61,036	66,499	50,692	243,909	233,592	186,311
Cleveland.	56,455	71,469	55,017	226,113	267,605	208,911
Colorado..	36,630	34,490	28,140	152,940	145,170	120,620
Columbus.	33,352	41,415	25,888	130,441	139,525	100,236
Indiana .	69,147	87,260	76,413	301,623	326,801	311,313
Lk. Supr.	22,022	30,032	19,435	99,495	114,015	83,240
Louisville.	46,334	50,165	38,312	178,727	182,303	167,910
Memphis .	20,480	21,801	17,614	85,277	89,254	76,124
Michigan .	58,284	66,790	52,234	245,924	269,824	204,572
Missabe R.	2,545	2,918	2,779	12,263	13,701	13,578
Mo. Val..	113,837	153,437	102,799	522,873	635,414	506,392
Nashville.	28,871	31,258	27,424	114,935	120,588	108,423
N. Y.-J. J.	82,432	121,010	108,926	330,706	433,845	392,887
No. Car..	35,184	41,905	38,019	140,873	141,951	137,211
N. E. Pa.	58,509	81,945	64,148	256,729	281,623	228,769
Pacific ..	68,668	95,425	81,616	282,408	346,617	320,518
Pac. N.W.	57,221	77,512	67,434	224,005	257,315	233,049
Philadel. .	168,596	208,973	147,471	711,978	739,007	517,337
Pittsburg.	283,533	255,426	143,015	1,131,810	896,524	532,163
S'eastern.	71,192	73,481	66,683	330,155	309,356	293,250
Southern .	22,850	42,099	39,431	102,280	146,368	166,650
Tennessee.	30,286	31,772	22,850	125,886	126,820	90,268
Tr. (Mpls)	130,530	152,862	106,743	553,280	571,577	465,419
Texas ...	66,477	75,556	57,448	298,462	345,811	281,907
Toledo ..	19,758	33,391	23,603	82,043	131,350	100,772
Utah ...	12,307	13,577	8,453	46,868	54,785	31,224
Virginia .	72,120	81,073	69,789	280,766	294,925	238,495
W'n N. Y.	68,385	86,173	63,333	281,711	325,816	240,019
W. (Oma.)	50,470	62,367	55,232	222,934	255,633	233,198
Wisconsin.	92,241	96,354	86,983	392,065	379,794	342,822
*Total..	2,350,356	2,773,531	2,133,877	9,876,120	10,447,314	8,437,033

*Reported by 36 associations.

—*Monthly Summary of Commerce and Finance.*

Conference of State Railroad Commissions at Chicago.

A conference of the railroad commissions of Illinois, Indiana, Michigan, Ohio and Wisconsin was held in Chicago on June 12 and 13. The New York Public Service Commission, second district, was to have been represented, but Martin S. Decker, the member of this commission who was to have attended, was taken sick and was unable to be present. C. L. Glasgow, Chairman of the Michigan Commission, which was the prime mover in bringing the conference about, was elected Chairman, and William Kilpatrick, Secretary of the Illinois Commission, was elected Secretary. The object of the conference was to take steps to secure greater uniformity of railroad regulation in the states represented.

The following responded to the roll call:

Illinois.—W. H. Boys, Chairman; B. A. Eckhart, J. A. Willoughby and William Kilpatrick.

Indiana.—Union B. Hunt, Chairman, and William J. Wood.

Michigan.—C. L. Glasgow, Chairman; George W. Dickinson and James Scully.

Ohio.—J. C. Morris, Chairman; O. H. Hughes, O. P. Gothlin, and H. D. Manington, Secretary.

Wisconsin.—John H. Roemer, and J. M. Winterbotham, Secretary.

It was decided to make the organization of the Commissions represented permanent, and a committee composed of W. H. Boys, John H. Roemer, O. P. Gothlin, Union B. Hunt and James Scully was appointed to draft a constitution and by-laws to be reported at the next meeting, which will be held in Chicago December 4, next. The temporary organization will continue until then.

The prevention of accidents was brought up for discussion by Mr. Wood of Indiana. Mr. Wood thought the railroad commissions could do more to stop accidents due to lax discipline than could railroad officers, because the commissions have no fear of the grievance committees of the labor unions. When the Indiana Commission found that discipline was lax it did not hesitate to ask for the discharge of the men at fault. It now has a case pending where the general manager and general superintendent of a railroad are regarded as incompetent, and the Commission is considering asking for their discharge. The inspectors of the Indiana Commission had found 1,000 different kinds of defects in cars. To stop casualties to trespassers he advocated legislation to require signs at crossings directing people to turn either to the right or to the left. He would post bulletins in stations, giving lists of the persons punished in the previous month for trespassing, as is said to be done in England. He advocated more stringent legislation for the punishment of trespassing, and agitation through the press and by other means to educate public sentiment so that it will demand the punishment of trespassers. There are 10,000 unprotected grade highway crossings in Indiana, and there should be legislation in all the states providing for the elimination of such crossings. He estimated that the average cost would be $25,000.

A resolution was passed for the appointment of a committee on this subject, to consist of one member from each Commission represented in the conference, and the following committee was appointed: J. C. Morris, William J. Wood, B. A. Eckhart, George W. Dickinson and J. M. Winterbotham.

The following resolution was also adopted:

That a committee of one member from each commission represented be appointed to formulate a statute to prevent trespassing on the tracks, cars and grounds of railroads, and that the commissions use their best efforts to popularize a movement to provide by law against trespassing on railroads, and to so inform and influence public sentiment that such statute will be effectively enforced. The steps taken by each commission shall be made known to all the commissions.

The following committee was appointed to carry out this resolution: J. A. Willoughby, O. H. Hughes, John H. Roemer, C. L. Glasgow and William J. Wood.

The matter of the reduction of interstate passenger fares in the eastern territory to the basis of the 2-cent intrastate rates was next taken up. It was agreed that the state Commissions can do nothing to secure reductions in interstate rates, except by using their influence with the roads to that end, and that the Interstate Commerce Commission has no power to require a general reduction, to the basis of the state rates, although it may, after specific complaint and hearing, require specific reductions if it be shown that the higher through rate is unreasonable. It was agreed that the railroads should for their protection be permitted to charge a penalty fare when cash fares are paid on trains. Mr. Roemer of Wisconsin said that he thought a year in prison would be most effective in preventing travelers from bribing conductors to carry them for less than the legal rate.

Recurring to the subject of accidents, Mr. Dickinson of Michigan criticized the lack of uniformity that he had found in the form of switch targets, and said that the Michigan Commission was trying to get all roads in that state to adopt the practice of having no target shown when the switch is set for the main track and of showing a circular disk painted red when the switch is set for a siding. He said that enginemen approved this plan as being desirable to prevent many accidents.

The rules of operation on interurban lines were discussed, and it was stated that in some cases such roads had no printed rules, and the enforcement of rules, even when they are printed, had been found lax. The operation of these roads had been found more dangerous than that of steam roads.

With reference to interchange of traffic between steam and electric lines, the discussion disclosed that the commissioners were agreed that generally interchange is impracticable because the electric roads have not the necessary equipment. It was agreed that the law should provide, as it has in some

states, for the requirement of interchange when special conditions justify.

The so-called "average rule" for demurrage was discussed at some length. Mr. Glasgow said that the operation of the Michigan average rule had been unsatisfactory and that the Michigan Commission is advising shippers not to sign contracts for the application of this rule. He said that the large shipper has an advantage over the small shipper under the average plan, and that 95 per cent. of the troubles of consignees that have been brought to the attention of the Commission have been caused by its operation. Mr. Gothlin of Ohio said that the average plan worked well in his state and that he thought it was the most equitable and best calculated to accelerate the movement of cars. Mr. Manington of Ohio took the same view as Mr. Gothlin. Mr. Hunt of Indiana asked why a shipper should be permitted to hold one car more than a reasonable free time because he had held another car less than that time.

Mr. Glasgow of Michigan brought up the subject of the state commissions getting information from the Central Freight Association. He thought that the commissions should be advised of intended changes in rates. Action on this matter was deferred to the December meeting.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Ft. Worth & Denver City has ordered from the American Locomotive Co. 13 simple locomotives, consisting of five heavy consolidation, three light consolidation and five six-wheel switching locomotives for July and August delivery.

General Dimensions.

Type of locomotive	Consolidation
Diameter of drivers	57 in.
Weight, total	196,400 lbs.
" on drivers	177,780 "
Cylinders	22 in. x 28 in.
Boiler type	Straight top
" working steam pressure	200 lbs.
" diameter	80 in.
Firebox, length	120 1/16 in.
" width	39 1/4 in.
Tubes, number	334
" diameter	2 in.
" length	13 ft. 6 "
Heating surface, tubes	2,346 sq. ft.
" " firebox	209 "
" " total	2,555 "
Grate area	32.7 "
Tender, style	Rectangular tank
" truck	Archbar, rigid
Water capacity	8,000 gals.
Coal capacity	10 tons

Type	Consolidation
Diameter of drivers	57 in.
Weight, total	185,000 lbs.
" on drivers	164,200 "
Cylinders	20 in. x 28 in.
Boiler type	Extended wagon top.
" working steam pressure	200 lbs.
" diameter	67 3/8 in.
Firebox, length	120 1/8 "
" width	39 1/4 "
Tubes, number	265
" diameter	2 in.
" length	14 ft. 2 "
Heating surface, tubes	1,967 sq. ft.
" " firebox	202 "
" " total	2,169 "
Grate area	32.7 "
Tender, style	Rectangular tank
" truck	Archbar, rigid
Water capacity	8,000 gals.
Coal capacity	10 tons

Type of locomotive	Switching
Diameter of drivers	51 in.
Weight, total	135,000 lbs.
" on drivers	135,000 "
Cylinders	19 in. x 26 in.
Boiler type	Straight top
" working pressure	180 lbs.
" diameter	66 1/4 in.
Firebox, length	108 1/8 "
" width	42 "
Tubes, number	280
" diameter	2 in.
" length	11 ft.
Heating surface, tubes	1,600 sq. ft.
" " firebox	152 "
" " total	1,752 "
Grate area	31.5 "
Tender, style	Sloping tank
" truck	Archbar, rigid
Water capacity	4,000 gals.
Coal capacity	6 tons

Special Equipment.

Boiler and firebox steel	Otis
Tires	Railway Steel-Spring
Springs	Railway Steel-Spring
Injectors	Monitor
Couplers	Tower
Journal boxes	Hewitt bronze
Headlights	Pyle-National
Tender brakebeams	National Hollow
Safety valves	Crosby
Lubricators	Nathan
Metallic packing	Jerome
Steam gages	Ashcroft
Bell ringers	Gollmar
Sanding device	Leach
Blow-off valves	Johnstone
Brake-shoes, consolidation	Diamond
" switching	Congdon
Driving wheel centers	Cast steel

CAR BUILDING.

The Lemac Carriers Co., Old Colony building, Chicago, has ordered from the Ryan Car Co. 50 poultry cars of 60,000 lbs. capacity. The body and truck bolsters will be furnished by the Scullin-Gallagher Iron & Steel Co.

The Colorado & Southern, as mentioned in the *Railroad Age Gazette* of June 12, has ordered 50 all-wood narrow gage gondola cars of 50,000 lbs. capacity and 50 all-wood narrow gage box cars of 50,000 lbs. capacity from its Denver shops. They will measure 29 ft. 6 in. long and 7 ft. 1½ in. wide, inside, and 32 ft. 8⅜ in. long, and 8 ft. 2½ in. wide, over all. The box cars will be 6 ft. 4¼ in. high, inside, and 10 ft. 3½ in. high from rail to top of running board, while the gondola cars will be 3 ft. 4 in. high, inside, and 9 ft. high, over all. The special equipment will include:

Axles	Steel
Bolsters, body and truck	Bettendorf
Brake-beams	Sterlingworth
Brake-shoes	Congdon
Couplers	Tower
Door fastenings, box cars	Security
Draft rigging	Miner tandem
Dust guards	Bass wood
Journal bearings	Hewitt solid lead lined
Journal boxes	Franklin
Roofs, box cars	Murphy
Side bearings	Miner
Springs	Railway Steel-Spring
Trucks	Bettendorf
Wheels	Cast iron

RAILROAD STRUCTURES.

AUSTIN, TEX.—The Texas & Pacific has had plans approved by the Railroad Commission of Texas for depot sheds to be erected at Judkins, Tex., Dothan and Lambert.

CLEVELAND, OHIO.—It is said that the Erie will replace the old swing bridge near the Central Blast Furnaces, at this place, with a rolling lift bridge, at a cost of about $100,000.

DENVER, COLO.—The Union Pacific, the Colorado & Southern, the Chicago, Burlington & Quincy and the Denver, North Western & Pacific are making plans for jointly building the proposed Twentieth street viaduct. The viaduct is to carry highway traffic across the tracks and yards of the various companies mentioned. The main portion of the viaduct will be about 4,407 ft. long, with one intermediate approach 700 ft. long. The main structure will have a roadway of 34 ft. clear width with a 6-ft. sidewalk on both sides. The superstructure will be of steel except the roadway, which will be of creosoted block paving laid on 5-in. timber plank. The sidewalks and curbs are to be of reinforced concrete. The structure proper for the most part will consist of ordinary deck trestle girder spans, but there will also be a number of through spans varying in length from 100 ft. to 166 ft. The contracts to be let include some 19,000 sq. yds. of block paving and 49,000 sq. ft. of concrete siding. It is expected that bids covering this entire work will be asked within a few weeks.

HIBBING, MINN.—See Duluth, Missabe & Northern in Railroad Construction columns.

JOHNSTOWN, PA.—The South Cambria, it is said, has given a contract to the Johnstown Construction Co. for putting up a 1,100-ft. viaduct over the Pennsylvania tracks at this place. The work is to be started at once, and will cost about $55,000.

NIAGARA FALLS, N. Y.—A number of railroad officials recently held a meeting to consider the question of building an

additional bridge over the Niagara river below the falls. H. J. Pierce, P. Norton and R. L. Fryer, all of Buffalo; F. A. Dudley, Niagara Falls, and F. S. Nichols, of Toronto, are interested.

SAN FRANCISCO, CAL.—The Atchison, Topeka & Santa Fe has been reported as about to make a large expenditure for improvements in the China basin, San Francisco, including a system of piers for deep sea vessels. We are advised that it is the intention of the company eventually to improve this property but that no immediate steps have been taken in that direction.

SIGNALING.

The General Railway Signal Co., Rochester, N. Y., recently closed contracts with the Lake Shore & Michigan for three electric interlocking plants, namely: At Indiana Harbor lift bridge, a 136 space machine with 89 working levers and 44 spare spaces; at Indiana Harbor crossing, an 88 space machine with 55 working levers and 33 spare spaces, and at Clark's Junction, a 108 space machine with 64 working levers and 44 spare spaces. This company also recently contracted to furnish the Erie Railroad with electric interlocking at Youngstown, Ohio, where a 64 space machine with 49 working levers and 15 spare spaces will be required.

SUPPLY TRADE NOTES.

T. F. Salter has been appointed Chief Engineer of the Standard Roller Bearing Co., Philadelphia, Pa.

The Dickson Car Wheel Co. lost by fire on June 6 its plant at Houston, Tex. The estimated loss is $150,000.

The L. M. Booth Company, New York, will hereafter concentrate its force on the manufacture and sale of its own types of water softening and purifying apparatus, particularly the Booth water softener.

John Stewart, who recently resigned as Auditor of the Indiana Harbor Belt, is now a railroad contractor, being a member of the firm of Stewart, Horton & Co., 405 Baltimore building, Chicago.

At the annual meeting of the Mt. Vernon Car Co., Mt. Vernon, Ill., the following officers were elected: W. C. Arthurs, President, succeeding D. O. Settlemire, deceased; R. K. Weber, Vice-President; D. P. Settlemire, Secretary and Treasurer; and Frank Snyder, Superintendent.

In the work of improving the factory grounds of the Crocker-Wheeler Co. at Ampere, N. J., an oak tree 60 ft. high was recently lifted by a Crocker-Wheeler locomotive crane, carried about 200 ft. and replanted near the post office which is being built on the company's property.

The Buffalo Foundry & Machine Co., Buffalo, N. Y., manufacturer of castings and builder of vacuum drying and impregnating machinery, compressors, pumps, etc., recently established a New York office at 143 Liberty street, in charge of H. E. Jacoby as Resident Engineer and Manager.

W. M. Kinch, for several years past with the Gordon Battery Co., New York, has been appointed Signal Engineer of that company, with headquarters at the office of the sales department, 39 Cortlandt street, New York City. Mr. Kinch, who was formerly Signal Engineer of the New York Central, has a wide acquaintance among railroad men.

C. S. Redfield, Advertising Manager of the Yale & Towne Manufacturing Co., New York, sailed for Europe on the "Potsdam," June 17, with his family. He intends to visit the branch offices of the company in Europe with his brother, J. M. Redfield, the company's European advertising manager, and will sail for home on the "Rotterdam" about September 1.

The International Car Co., New Orleans, La., has been incorporated in Louisiana with $200,000 capital stock to repair and rebuild freight cars, coaches, locomotives and all other railroad and industrial equipment. The officers of the company are: President, Seeley Dunn; Vice-President and General Manager, A. T. LeBaron; Secretary, J. C. Flett, of New York. C. A. Ralston and several other prominent railroad supply men are on the Board of Directors. Messrs. LeBaron and Ralston are members of the firm of Ralston & LeBaron, 702 Fisher building, Chicago, and are also among the incorporators of the Ralston Car Works, Omaha, Neb., reported in the *Railway Age* of April 10. For the works to be erected at New Orleans, 15 acres of land have been bought and construction will be commenced soon.

At the annual election of the Consolidated Car Heating Co., New York, held on June 9, J. H. Manning, formerly Vice-President, was made President, succeeding R. C. Pruyn, resigned. C. S. Hawley was made Third Vice-President and General Manager, succeeding F. C. Green, resigned. Thomas Farmer, Jr., becomes District Manager of the eastern territory and C. C. Nuckols Superintendent and Purchasing Agent.

The Bureau of Manufactures, Washington, D. C., reports (inquiry No. 2352) that plans are under way in an Asiatic country for an electric road about five miles long to connect with a steam railroad that will be about seven miles long. The American consul in that region reports that surveys have been made, and suggests that interested parties correspond with a native capitalist, who will furnish the funds necessary for the construction of the proposed lines.

The Allis-Chalmers Co., Milwaukee, Wis., received during May a number of contracts for standard electrical motors and generators. The company reports that with each month's sales since the first of January the gains over the preceding month have been sufficient to warrant a decidedly encouraging outlook. Among the sales were a 175-k.w. belt alternator for the New Jersey Consolidated Water & Light Co.; an 800-k.w. generator for the Great Western Portland Cement Co. for installation in its plant at Mildred, Kan.; a 250-k.w. alternating-current generator wound for 60-cycle, three-phase, 2,300-volt circuits, for the Northampton Electric Lighting Co., Northampton, Mass. A second contract has also been received from the Athens Electric Railway Co., of Athens, Ga., for a 1,000-k.w. steam turbo-generator unit.

The Consolidated Supply Co., 321 Dearborn street, Chicago, has been incorporated to handle steam and electric railway supplies and mill and mining supplies. The office and store occupy the ground floor of the Manhattan building. The incorporators are: L. C. Hopkins, John P. Mahoney and J. L. Benedict. Mr. Hopkins has had about eight years experience in railroad and supply business, having been connected for the past year with the sales department of the Chicago Pneumatic Tool Co., Chicago, and before that was for four years with Fairbanks, Morse & Co., Chicago. Mr. Mahoney was formerly chief clerk to the Purchasing Agent of the Toledo, St. Louis & Western. Mr. Benedict has been in railroad business for ten years and for the last five or six years has been with the Chicago Pneumatic Tool Co. as manager of its Chicago office and associated with the sales department.

TRADE PUBLICATIONS.

Speedometers.—A handsome catalogue of the Stewart Railway Speedometer Co., Railway Exchange, Chicago, illustrates and describes the Stewart railroad speedometer.

Fireproofing.—A catalogue of the General Fireproofing Co., Youngstown, Ohio, describes the incombustible materials of construction used by this company in fireproofing.

Disinfectants.—A folder issued by the Alcatraz Co., Richmond, Va., gives a price list and description of the disinfectants manufactured by this company and their uses.

Babbitt Metal.—Bulletin No. 1, recently issued by A. Allan & Son, New York, contains a description of Allan metal, its practical applications and comparisons of it with other babbitt metals. This bulletin is the first of an intended series.

Lathes, Boring Mills, etc.—A catalogue of the Gisholt Machine Co., Madison, Wis., describes different machine tools, including turret lathes, vertical boring and turning mills and universal tool grinders, and discusses the uses of the machines and methods of finishing different classes of work. Accompanying the catalogue is a flexible binder designed especially for use in preserving the bulletins which will be issued from time to time; also a booklet illustrating and describing Gisholt

methods as applied to railroad shops. A number of drawings show the method of finishing such work as piston centers, eccentrics, crossheads, etc.

Dynamo Brushes.—The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has just issued a 16-page pamphlet illustrating and describing its Wirt type dynamo brushes, designed for use with low tension d.c. motors and generators, a.c. generators, plating dynamos, excitors, etc. In addition to descriptive matter and price list, the pamphlet contains useful information on the care of commutators and brushes, the means of correcting lap, etc.

Low Cost House Designs.—F. W. Bird & Son, East Walpole, Mass., have just issued an interesting pamphlet describing and illustrating the results of a contest entered into by 432 architects in the United States and Canada. Wishing to erect a number of cottages in connection with their paper mills at East Walpole, Bird & Son asked for competitive designs of a $3,000 house, using the products of the paper mills as exterior covering. The report of the judges and reproductions of the best 13 designs are given in the pamphlet.

Pricing Requisitions Before Purchase.

In a paper on "The Value of Pricing Requisitions Before Purchase," read before the Railway Storekeepers' Association, R. L. Morris advocated the practice on the ground that when the requisitions are received by the general storekeeper, it is very easy for him to compare the figures to determine whether or not they are correct and enables him, with very much less work and time, to go over them and in an intelligent manner approve them. When the general storekeeper has finished with them, all that is left to be done is to have the approval of the general manager, an official who is too busy to go into such matters in detail. And here is where pricing requisitions is of an immense value for the reason that the general storekeeper can prepare for the general manager a statement showing the value of various classified items, at the same time, showing the consumption of this material the previous month, and if desired, the amount of the requisitions the corresponding month last year.

Western Union Dividend Cut.

The directors of the Western Union have declared a quarterly cash dividend of one-half of 1 per cent., thus reducing the annual rate from 5 per cent. to 2 per cent. The two previous quarterly dividends were made payable in stock.

Extension of Hudson Tunnel.

The Hudson & Manhattan tunnel, beneath the Hudson river, between Hoboken, N. J., and New York City, now has its New York terminus at Twenty-third street and Sixth avenue, having been extended northward from Eighteenth street, which has been the temporary terminal.

Honorary Degree for Dr. Benjamin.

Dr. Charles H. Benjamin, Dean of the Schools of Engineering, Purdue University, received the honorary degree of Doctor of Engineering at the recent commencement of the Case School of Applied Science, Cleveland, Ohio.

Columbia University.

Professor Arthur L. Walker has been appointed Professor of Metallurgy and Administrative Head of the Department of Metallurgy at Columbia University, effective July 1. He will personally direct instruction in non-ferrous and electro-metallurgy and metallurgical design. Professor Howe will continue to deliver his lectures on iron and steel as heretofore. Since his graduation from the School of Mines of Columbia University, in 1883, Professor Walker has been engaged in metallurgical and mining work for the Old Dominion Copper Co., the Guggenheim properties and others, while more recently he has been a consulting metallurgical engineer.

Grand Trunk Apprentices' Premiums.

Forty-two apprentices in mechanical drawing and practical mechanics, who have attended the classes maintained by the Grand Trunk Railway during the past winter, have just been awarded prizes. The number of apprentices competing at the examinations was 283, and marked progress was shown in both departments. The company has sent to the Master Mechanics' convention at Atlantic City a large exhibit showing the work of these young men. Classifying by stations, the highest standing was awarded to Montreal; the second to Stratford; third to Gratiot; fourth, Toronto; fifth, Portland.

Degree for Angus Sinclair.

At the recent Purdue commencement the honorary degree of Doctor of Engineering was conferred on Angus Sinclair, Editor of *Railway and Locomotive Engineering*, and author of many well-known books on locomotive building and operation.

North Borneo Railroad.

The British North Borneo line is the only railroad in the territory that was built and is owned and operated by the government. The construction of the road commenced in 1896, and the line was completed from Jesselton, on the west seacoast, to Tenom, in the interior, with a branch from Beaufort to Weston, in 1905. A further extension, from Tenom to Melalap, of 10 miles is now under construction, and Dutch rails are being used. On the main line there are 62 miles of British-made 30-lb. rails and 60 miles of American rails of the same weight, totaling at present 132 miles of meter gage (3 ft. 3 in.), of which 122 miles are in operation. The total cost of building, including rolling stock, etc., up to the end of 1905 was $2,800,000.

The construction of the road was extremely difficult on account of the nature of the country, and the builders evidently desired to complete the road as cheaply and quickly as possible. For two-thirds of the distance from Jesselton to Beaufort the road is parallel to the seacoast, and it is not until it runs inland that good country is opened. From Beaufort to Tenom the road follows the course of the Padas river, and 33 miles of cuttings were made in the gorge, which is very narrow. As the hills on either side are steep and high the line still fails to open up country. Had the line been built further inland, it would have cost much more and would have taken longer to build, but it would have passed through the rich valleys of the foothills. Beyond Tenom the soil is well suited to the cultivation of tobacco and rubber.

It is the government's intention, it is said, to extend the line beyond Melalap. If this is done it will pass through a rich valley, but it will probably be several years before this is accomplished.

The rolling stock at present consists of four freight and five passenger engines, and 160 freight and 18 passenger cars. Of the engines, one is 35 tons, two are 30 tons, four are 25 tons and two are 12 tons. The largest freight cars are 16 ft. in length and have a capacity of 10 tons; the passenger cars are 30 ft. in length and accommodate 40 passengers. About 50 16-ton meter-gage steel trucks were ordered from England in 1907, but the order has not been filled to date.

Two passenger trains are run daily (Sunday excepted) between Jesselton and Tenom, one in each direction. The average rate of speed of passenger trains is 12 miles an hour. Freight trains are run between Jesselton and Beaufort three times a week and between Beaufort and Tenom twice a week, one in each direction.

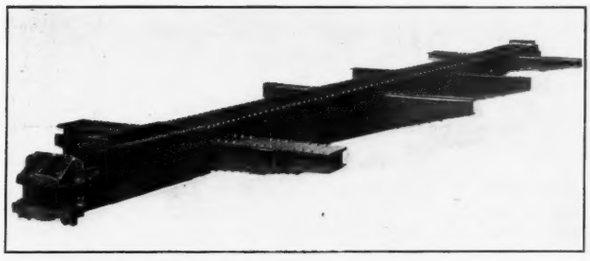
There are about 70 bridges, of which the longest is 600 ft., and two tunnels 600 and 200 ft. respectively. During the rainy season, or about half the year, the roadbed is continually being washed out and landslides occur after each heavy rain, but as labor is cheap the upkeep of the line is about $14 per mile per month.

The revenue and expenditure of the railroad for the year

1906, the latest year for which statistics are available, were as follows: Operating expenses, $60,258; receipts, $37,237; deficit, $23,021.—*Consular Report.*

Steel Underframe for Refrigerator Cars.

Refrigerator cars, escaping as a rule the rough handling of hump yards and having the advantage of being hauled in fast through trains which are not frequently started and stopped, do not require the heavy underframe construction that cars of higher capacity handling rough freight demand. For this reason the refrigerator car of wooden underframe construction is in general service to-day. Many companies operating or building refrigerator cars have, however, applied steel under-

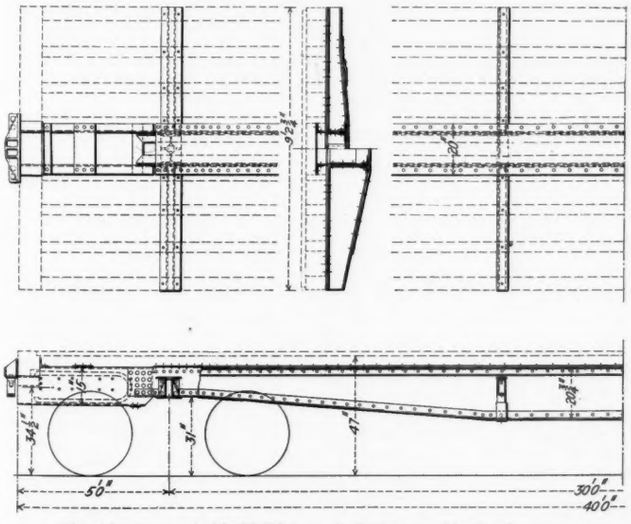


Ralston Steel Underframe for Refrigerator Cars.

frames to their equipment, the resulting low cost of maintenance more than offsetting any increase in the first cost.

The refrigerator car presents problems of design not found in ordinary box and stock car construction, in that the underframe must be adapted for application without affecting the method of insulating the car. The icing of refrigerator cars places a load of approximately 4,000 lbs. at a point between the bolster and end sill and necessitates a construction heavy enough at this point to take care of this loading, as well as the shocks due to ordinary and extraordinary rough handling by trainmen.

The underframe shown in the accompanying drawings and photograph was designed by the Ralston Steel Car Co., Colum-



Sections and Half-Plan of Ralston Underframe.

bus, Ohio, for application to the refrigerator equipment of the Merchants' Despatch Transportation Co. The underframe is of the fish-belly type, 20¾ in. deep, built up of ¼-in. web and cover plates and 3½ in. x 3 in. x ⅜-in. angles, with needle beams composed of $\frac{5}{16}$-in. diaphragm plates and $\frac{5}{16}$-in. x 4-in. top and bottom cover plates. The bolsters are of the built-up type, 9 in. deep and composed of $\frac{7}{16}$-in. pressed plates, with ½-in. x 12-in. compression and tension members. A 15-in. channel, riveted to web plates, with draft lugs butting against the bolster filler casting, which is extended to meet the draft lugs, in combination with the heavy bolster above described, makes a strong end construction for this type of car. The depth and weight of the needle beams, in connection with the depth of the center girder, insures alinement. Wooden end and side sills are to be used, the side sill being bolted to the top of the bolsters and needle beams, while the end sill rests on a shelf formed by notching and bending the ends of the draft channels. The end sill is further protected by a heavy striking casting and reinforcing angle placed behind it, the latter being securely riveted to the flanges of the draft channel.

Quebec Railroad Development.

James G. Scott was the promoter, builder and is now the general manager of the Quebec & Lake St. John Railway—a part of the Canadian Northern system. At a recent dinner in his honor he recalled the Quebec railroad events of the last 38 years and looked to the future as follows:

"To give Quebec complete control of the back country which belongs to her there remains still another great work to be accomplished, and this the rising generation will have to see to. I refer to the opening up of the James Bay territory. There is in that territory a vast area comprising 70,000 square miles, or 45,000,000 acres of land, absolutely untouched, belonging to the Province of Quebec. This great region abounds in spruce forests, in water powers, in arable lands, in lignite coal and in minerals, and it has a climate quite as good as the Lake St. John district and very similar to that of Manitoba. A railroad from Roberval to James Bay would pass exactly through the center of this great territory, and would touch at half way the valuable mining district of Chibougamo, where there are great deposits of asbestos, copper, gold and iron.

"But stronger hands than ours are now working for the railroad development of Quebec. The National Transcontinental Railway, the eastern connection of the Grand Trunk Pacific, is now being built from Quebec up the valley of the St. Maurice in a direct line to Winnipeg. When this new road, splendidly constructed with maximum grades of fourtenths of one per cent., is finished, the distance from Quebec to Winnipeg will be only 1,350 miles, as compared with 1,570 miles by the Canadian Pacific, and the new settler or the European tourist landing from the ocean steamer at Quebec will be able to reach Winnipeg, passing in a straight line, through the interior of the country, touching the northern shores of the magnificent lakes Abbittibi and Nipigon—the first as large as and the second much larger than Lake St. John—in a third of a day less than it now takes to make the trip. And the freight trains coming east from Winnipeg will, it is said, be able, on account of the level road, to haul such tonnage that it will be as much as six cents per bushel cheaper to send the wheat to Quebec all rail than to tranship it to the lake vessel at the head of Lake Superior, as is now being done."

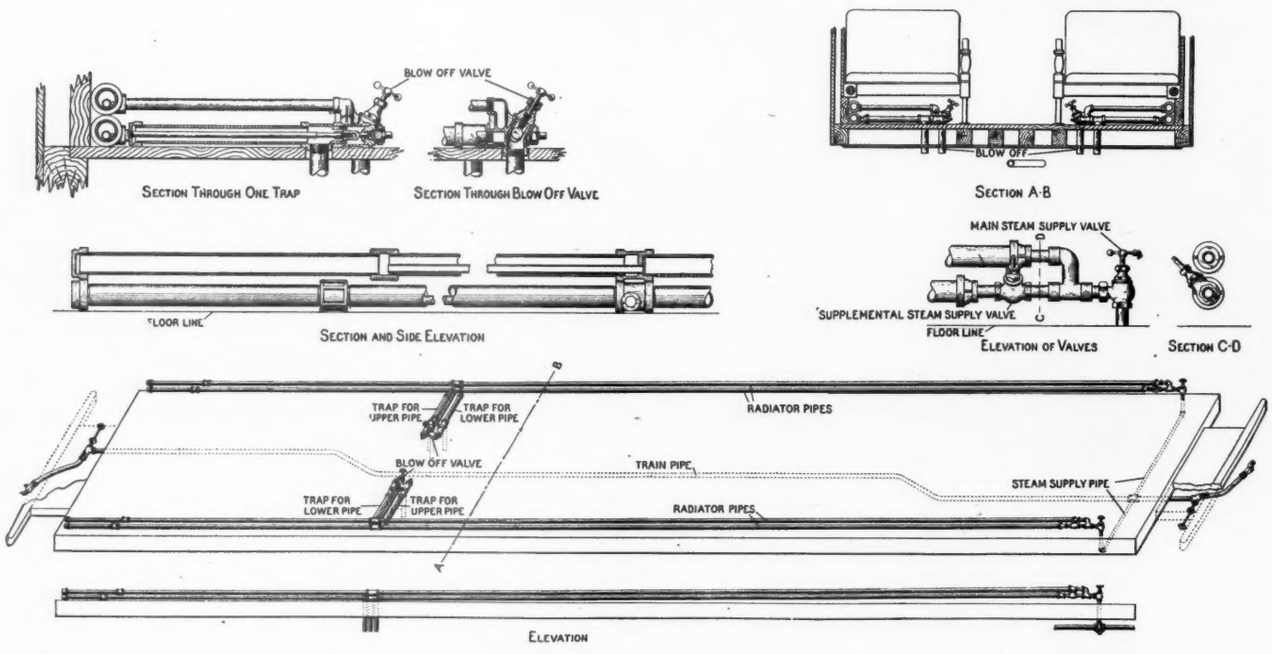
Work of Kansas Railroad Commissioners.

The Kansas Board of Railroad Commissioners has prepared a statement of the cases docketed by it during the period from November 1, 1906, to June 1, 1908, and of its more important acts during this time. According to a newspaper summary of this statement, 22 proceedings were begun for the establishment of agencies at stations; 21 related to alleged discrimination in the furnishing of cars; 19 were for the construction of stations; 7 sought the improvement of express service or a reduction in express rates; 10 sought reductions in freight rates; 4 better freight service, and 10 additional passenger service; 8 related to switching rates and the construction of switching tracks; 4 sought the construction of stock yards; 10 related to the establishment of telegraph service; 11 sought to secure improved train service, and 7 related to telephone wires crossing railroad rights of way and tracks. Among the acts of the Board were the following: An order requiring bulletining of the time of arrival of passenger trains; an order requiring waiting rooms to be kept open for the accommodation of the public; orders to prevent discrimination in the furnishing of cars; an order prohibiting the "dead-heading" of Pullman cars through Kansas and requiring such cars to be thrown open to the service of the public; an order requiring the construction of establishment of freight facilities

at Kansas City, Kan.; an order for the establishment of "terminal rates" between all stations in Kansas and Kansas City, Kan.; an order for the re-establishment of passenger train service on four branch lines of the Missouri Pacific; the securing of a general reduction of a mill per ton per mile on coal from the Pittsburg and Osage fields to stations in Kansas; an order promulgating a general Kansas distance tariff on classes and commodities, which, unless overthrown by the litigation started by the railroads, will reduce interstate freight rates approximately 20 per cent.

Regulating Direct Steam Heating System.

The Safety Car Heating & Lighting Co., New York, has developed a regulating system of direct steam heating, in which the system is so arranged that the amount of radiating pipe in service may be varied at will. If the radiating surface is kept constant and the steam pressure varied, the difference in tendency to heat the surrounding air between a pipe containing steam at, say, 45 lbs. (290 deg. F.) and one at 2 lbs. pressure (218 deg. F.), amounts to only 72 deg., or but 25 per cent. Nor can this result be accomplished by maintaining steam in the radiators at atmospheric pressure, as it is then possible to neither increase nor diminish the temperature of the radiators, and there is no control of the amount of heat delivered to the car.



Regulating Direct Steam Heating System.

In the system referred to, there are four radiating pipes running the length of the car, two being on each side of the car, and each pipe being supplied with independent admission valve and automatic trap for taking care of the water of condensation. It is thus possible to use either one, two, three or four pipes at a time; or, considering four pipes as the maximum, to reduce the heating effect either 25, 50 or 75 per cent., as may be desired.

By reference to the drawing, it will be seen that steam is taken from the train pipe by means of a cross, No. 897, passing through a 1-in. pipe to admission valves No. 980, located on opposite sides of the car. When both valves, No. 980 and 905, are opened wide, steam will enter both the upper and lower pipes of the system, and the maximum heating effect will be obtained. It will be noted, however, that valve No. 905, which controls the lower pipe, is arranged to be operated by a key or wrench, the object being to keep this valve closed the greater part of the time, thus avoiding overheating the car. This will also materially help in preventing the rear cars from being robbed of steam when first heating up long trains. In very cold weather, however, if more radiating surface is desired, valve No. 905 is opened on either one or both sides of the car.

The use of this system will also considerably reduce the cost of keeping cars warm at terminals and yards, as ordinarily a car which is not moving and whose doors, windows and ventilators are closed, may be kept sufficiently warmed by the use of but one of the four radiating pipes.

By reference to the drawing it will be seen that at a point about two-thirds the length of the car from the steam inlet a special 2-in. x 1-in. eccentric T is located in each radiating pipe (either No. 987 or No. 988). This T is cast with a vertical web or wall, in which are two openings, one tapped with ¾-in. pipe thread and the other being a small hole for facilitating drainage. A ¾-in. pipe, which is screwed into the larger opening, lies along the bottom of the 2-in. radiating pipe and extends to coupling No. 732 located a few feet from the end of the 2-in. pipe. One-inch pipes connect these special T's on each side of the car with fittings No. 986, in which are incorporated a blow-off valve and two horizontal traps, constructed in such a manner that each of the 1-in. pipes is independently connected through a separate passage with its corresponding trap. The blow-off valve is so arranged that it may be used to operate both the upper and lower pipes. Into the outlet of each trap and of the blow-off valve is screwed a 1½-in. drain pipe, passing down through the car floor.

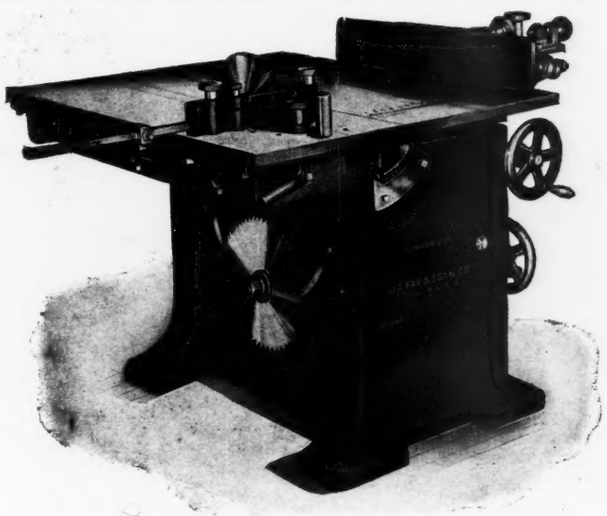
If either of the No. 980 valves be opened (all other valves being closed) steam will enter and pass along the upper 2-in. radiating pipe on one side of the car until it reaches the special T (No. 987 or No. 988). It will then pass through the ¾-in. pipe (which is introduced to prevent air being pocketed in the dead end of the radiator), expand and fill the remainder of the 2-in. pipe and pass through the 1-in. connection to the inlet of one of the automatic traps in fitting No. 986. This trap consists of a brass pipe extending horizontally nearly to the radiator and containing a small iron rod permanently attached to one end of the brass pipe, the other end being free to slide and carrying an adjustable disk which seats against the end of the brass pipe. When the car is first put in service this trap is opened wide and steam allowed to blow through it until it is thoroughly hot. It is then closed by turning up the projecting steam with a key or wrench and permanently securing it by the lock nut shown. Thereafter the trap will require no further adjustment, as, on account of the difference in contraction or expansion between the iron rod carrying the valve disk and its surrounding brass pipe, the valve will tend to open when the trap cools, or close when it becomes warmer, thus automatically allowing the water of condensation, but no steam, to pass out through the drain pipe. The traps are

adjusted and the entire system operated from within the car, making it unnecessary to get under the car for any purpose.

The operation of each of the other three radiating pipes is identical with that of the one referred to above, and any of the radiators may be turned on or off at will without touching the traps or blow-off valves. The traps being wholly within the car, it is almost impossible for them to freeze. Should, however, either of them become frozen after steam has been cut off from the car, it could be readily thawed out by simply turning steam into the remaining pipes.

Double Circular Saw.

A combined ripping and cross-cutting saw, differing in a number of respects from other similar machines, is shown in the accompanying illustration. Both saw arbors are carried on a revolving frame, and it is easy to take off or put on saws without disarranging the table. Two saws up to 16 in. in diameter (one on each arbor) can be carried at the same time and the frame revolved. If only one saw is used it may be as large as 20 in. in diameter. The table is made in two sections. A moving section, 44 in. x 16 in., travels easily on frictionless rollers, and a stationary section, 44 in. x 20½ in., has an extension, so that material up to 20 in. in width can be ripped. The moving section of the table has sufficient movement to edge or cut off material up to 35 in. and will open to



Double Circular Saw.

permit the use of 2-in. grooving head. The whole table can be tilted to an angle of 45 deg. from the saw by a hand wheel. A gage registers the angle to which the table is tilted. The ripping fence may be set to take stock up to 20 in. wide and used on either the right or left-hand section of the table. The fence has a micrometer adjustment for use when the adjustments are too fine to be made by hand. The miter cut-off fence is used on the sliding table, and covers a range from 45 deg. back of the fence to 60 deg. in front. It has a stop-rod for stock of various lengths. This saw is built by the J. A. Fay & Egan Co., Cincinnati, Ohio.

"Miners' Demonstration" at Southport.

The above is the title of a pamphlet issued by the operating department of the Lancashire & Yorkshire last month, from which it appears that that company, on May 23, ran to Southport, near Liverpool, 88 special trains, carrying about 60,000 passengers. We are informed by an officer of the company that all of the trains arrived practically on time; and not a passenger was injured. These trains came mostly from points from 20 to 50 miles distant. A considerable number of them were received from the London & North Western. The special arrangements made for these extra trains included, not only the suspension of nearly all of the freight traffic for one day, but also the installation of temporary fixed signals at a number of places. These signals are all described and illustrated in the circular, the same as would be done in the case of a permanent change in interlocking. Five pages of the circular are filled with notes showing changes in the hours of block signalmen, including the establishment of temporary block stations at a number of places. The whole pamphlet fills 33 pages, and this is supplemented by another one of 20 pages, giving the special assignments of the inspectors, signalmen, porters and shunters. For men kept on duty irregular or unusually long hours, meals were provided by the company. For breakfast at 4 a.m. they had tea or coffee and bread and butter; breakfast between 8 and 10 a.m., tea or coffee, beef, ham, bread and butter; dinner at 12.30 p.m., cold meat, hot potatoes, cider, ginger beer or mineral water; tea between 3 and 4 p.m., meat and bread and butter; supper between 7 and 9 p.m., sandwiches and hot coffee.

Employees Protest Against Unreasonable State Rates.

The employees of the Union Pacific in Nebraska have sent to the state railroad commissioners of that state a protest against further radical reductions of freight rates, in which some of the arguments sustaining their position are set forth with much force. Comparing March of this year with the same month one year ago, they show that the engine mileage on their road in Nebraska decreased 40 per cent., and train mileage 34 per cent. The number of men employed by the company in that state was about 2,300 less than in March, 1907, the number of men dismissed or suspended in the station service being 167; in the train service, 234; enginemen, 200; roadway, 1,010, etc., and these dismissals in all departments made a reduction of 34 per cent. in the pay roll, or about $148,000 a month. Instances are given, with the names of the men, showing reduced earnings, as for example, a blacksmith reduced from $81 to $66; an engineman, from $184 to $94; a fireman, from $101 to $82; an agent, from $78 to $65; an operator, from $70 to $63; a conductor, from $140 to $107, and so on. The memorial reminds those Omaha people who think that the railroads can avoid reducing their employees' wages by reducing dividends to the stockholders, that these stockholders receive only about 4 per cent. What business man in Omaha would be content with that rate of income?

The prosperity of the Union Pacific in Nebraska has been largely due to the large volume of trans-continental traffic which it carries, for which the state should be thankful, as it deserves no credit for it. In 1907 the U. P. spent $4,711,800 on new work in Nebraska. The plea that capitalists should be given reasonable returns on their money is not an academic question in Nebraska, for the state still has vast areas of land undeveloped. Thousands of acres which can be made profitable by irrigation and by dry farming are waiting for new railroads. When these lands are opened they will add greatly to the taxable property of the state. It is true that railroad rates in Nebraska are higher than in Iowa, but Iowa has 6.33 miles of railroad to each 36 square miles, where Nebraska has only 2.71 miles; and Iowa has 40 people to the square mile, while Nebraska has only 14. The average value of land in Iowa is $70 an acre; in Nebraska $22.

The employees resent the implication that they have been coerced, and they declare that there is no disagreement among themselves and the officers of the road, or between themselves and the actual farmers. They have no desire to curtail the service afforded the public, but, on the other hand, desire to see it enlarged. In Georgia the state reduced the rates on the railroads so that the railroads' receipts fell off two millions of dollars a year; and then the whole of this saving was absorbed by the middlemen, many of whom lived outside the state.

Crop Report of June 8, 1908.

The Crop Reporting Board of the Bureau of Statistics of the United States Department of Agriculture finds, from the reports of correspondents and agents of the bureau, as follows:

Area sown to spring wheat is estimated to be 3.7 per cent. more than the area sown last year, indicating a total area of about 17,710,000 acres, or 631,000 acres more than sown last year. The condition of spring wheat on June 1 was

95.0 per cent. of a normal, as compared with 88.7 on June 1, 1907; 93.4, June 1, 1906, and 93.2, the June 1 average of the past 10 years. Comparisons for important states follow:

States.	Spring wheat. Acreage, 1908. Per cent. of 1907.	Acreage, 1908. Acres.	Condition, June 1. 1908.	1907.	10-yr. average.
Minnesota	103.0	5,356,000	95.0	86.0	92.0
North Dakota	107.0	5,899,000	97.0	90.0	94.0
South Dakota	102.0	2,958,000	97.0	90.0	95.0
Washington	105.0	998,000	93.0	96.0	94.0
United States	103.7	17,710,000	95.0	88.7	93.2

The condition of winter wheat on June 1 was 86.0 per cent. of a normal as compared with 89.0 on May 1, 1908; 77.4 on June 1, 1907; 82.7, June 1, 1906, and 81.0, the June 1 average of the past 10 years. Comparisons for important states and divisions follow:

States.	Winter wheat. Per ct. of U.S. acreage in state.	Condition. May 1, 1908.	June 1. 1908.	1907.	10-yr. June av.
Kansas	19.4	84.0	78.0	60.0	78.0
Indiana	9.2	94.0	92.0	78.0	74.0
Illinois	7.8	94.0	88.0	89.0	76.0
Nebraska	7.6	87.0	86.0	80.0	86.0
Missouri	7.5	92.0	84.0	84.0	83.0
Ohio	7.0	91.0	92.0	80.0	76.0
Pennsylvania	5.3	88.0	92.0	92.0	86.0
Oklahoma	4.5	92.0	85.0	61.0	83.0
California	3.3	60.0	65.0	75.0	77.0
Texas	3.1	88.0	84.0	44.0	74.0
Michigan	2.9	90.0	91.0	75.0	72.0
United States	100.0	89.0	86.0	77.4	81.9
Divisions:					
North Atlantic	7.6	87.9	91.0	89.4	85.7
South Atlantic	10.0	90.6	89.3	87.3	84.2
N. Cen. E. of Miss. R.	27.1	92.8	90.7	81.5	74.9
N. Cen. W. of Miss. R.	34.8	86.5	81.2	69.8	80.9
South Central	13.8	92.4	86.8	70.7	81.2
Far West	6.7	78.7	80.0	82.4	83.8

The area sown to oats is estimated to be 0.6 per cent. less than the area sown last year, indicating a total area of about 31,644,000 acres, or 193,000 acres less than last year. The condition of the oats crop on June 1 was 92.9 per cent. of a normal, as compared with 81.6 on June 1, 1907; 85.9 on June 1, 1906, and 88.9, the June 1 average of the past 10 years. Comparisons for important states and divisions follow:

States.	Oats. Acreage, 1908. Per cent. of 1907.	Acreage, 1908. Acres.	Condition, June 1. 1908.	1907.	10-yr. average.
Iowa	101.0	4,545,000	97.0	85.0	94.0
Illinois	96.0	3,984,000	89.0	86.0	88.0
Minnesota	106.0	2,682,000	96.0	89.0	92.0
Nebraska	101.0	2,549,000	91.0	85.0	91.0
Wisconsin	100.0	2,350,000	97.0	87.0	94.0
Indiana	92.0	1,671,000	89.0	85.0	86.0
Ohio	97.0	1,552,000	92.0	83.0	84.0
Michigan	96.0	1,409,000	90.0	75.0	89.0
South Dakota	103.0	1,365,000	97.0	89.0	94.0
North Dakota	106.0	1,399,000	98.0	89.0	93.0
New York	99.0	1,196.000	94.0	87.0	90.0
Kansas	91.0	994,000	85.0	30.0	77.0
Pennsylvania	100.0	1,003,000	95.0	82.0	86.0
United States	99.4	31,644,000	92.9	81.6	88.9
Divisions:					
North Atlantic	99.7	2,492,000	94.9	85.3	88.5
South Atlantic	99.7	985,000	89.4	84.5	83.7
N. Cen. E. of Miss. R.	96.3	10,966,000	91.3	84.2	88.6
N. Cen. W. of Miss. R.	101.6	14,177,000	94.6	81.5	91.0
South Central	96.4	1,707,000	87.9	59.3	79.3
Far West	106.1	1,317,000	92.6	92.9	95.4

The area sown to barley is estimated to be 3.9 per cent. more than the area sown last year, indicating a total area of about 6,697,000 acres, or 249,000 more than last year. The condition of the crop on June 1 was 89.7 per cent. of a normal, as compared with 84.9 on June 1, 1907; 93.5 on June 1, 1906, and 89.5, the June 1 average of the past 10 years. Comparisons for important states follow:

States.	Barley. Acreage, 1908. Per cent. of 1907.	Acreage, 1908. Acres.	Condition, June 1. 1908.	1907.	10-yr. average.
Minnesota	104.0	1,232,000	96.0	86.0	92.0
California	104.0	1,082,000	70.0	78.0	81.0
South Dakota	106.0	928,000	97.0	90.0	94.0
North Dakota	110.0	940,000	96.0	90.0	93.6
Wisconsin	103.0	825,000	95.0	90.0	93.0
Iowa	103.0	573,000	97.0	85.0	95.0
Kansas	92.0	337,000	60.0	60.0	82.0
Washington	103.0	170,000	93.0	98.0	96.0
Nebraska	102.0	118,000	91.0	85.0	93.0
United States	103.9	6,697,000	89.7	84.9	89.5

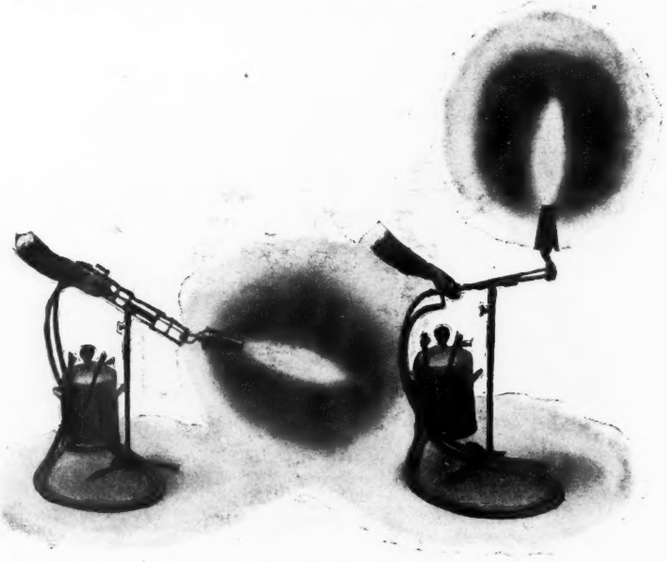
The condition of rye on June 1 was 91.3 per cent. of a normal, as compared with 90.3 on May 1, 1908; 88.1 on June 1, 1907; 89.9 on June 1, 1906, and 90.0, the June 1 average of the past 10 years.

The condition of meadows (hay) on June 1 was 96.8 per cent. of a normal, as compared with 93.5 on May 1. The condition of hay lands and pastures on dates indicated, by divisions of the United States, is as follows:

Divisions.	Hay, condition. May 1, 1908.	June 1, 1908.	Pastures, condition. May 1, 1908.	June 1. 1908.	1907.	10-yr. June av.
North Atlantic	92.6	98.5	91.1	98.7	83.3	89.3
South Atlantic	93.1	92.7	94.8	95.9	85.3	86.6
North Central:						
E. of Miss. R.	95.8	98.3	95.0	100.0	76.8	90.5
W. of Miss. R.	93.4	96.4	93.5	97.4	75.5	93.4
South Central	96.0	94.4	97.0	97.1	87.6	91.4
Far West	88.6	90.9	84.8	88.7	94.5	96.5
United States	93.5	96.8	92.6	97.7	80.6	91.3

The Hauck Portable Burner.

The accompanying illustration shows the improved form of Hauck burner. This form is adjustable so that it can be used in any position, as the two views show, and is particularly adapted to steel car repairs, as the heat may be directly applied to parts which are not easily accessible. The tank holds crude oil, which is carried by tubes to the burner, where, by a device protected by a basic patent, it is combined with compressed air into a heavy gas. This burns with a blue flame, giving an intense heat. The combustion being complete, there is no smoke and no waste of oil. The burner is entirely self-



Hauck Portable Burner.

contained. In starting it, about 12 lbs. pressure is pumped into the tank by the hand pump attached to it, and after the gas is lit the burner needs no further attention. These burners are used in boiler shops for flanging, heating crown sheets, patching, bending pipes, etc., and in repair shops for brazing and general repairs. Among the railroads using it are the Pennsylvania, the Lehigh Valley and the Atlantic Coast Line. It was invented by Arthur E. Hauck, and is made by the Hauck Manufacturing Co., Brooklyn, N. Y., which also makes burners to be used when an outside supply of compressed air is available, and also portable rivet heating forges and brazing forges.

Inland Waterways Commission.

President Roosevelt has announced a new Inland Waterways Commission; and its personnel is almost the same as it was in the former commission. The commission is now made up as follows: T. B. Burton, House of Representatives, chairman; Senators William B. Allison, William Warner, Francis G. Newlands, and John H. Bankhead; Joseph E. Ransdell, House of Representatives; Gifford Pinchot, Forester, Department of Agriculture; F. H. Newell, director reclamation service; H. K. Smith, chief of the bureau of corporations, Department of Commerce and Labor; Dr. W. J. McGee, Department of Agriculture; Prof. George F. Swain, Massachusetts Institute of Technology.

Railroad Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

F. P. Frazier, of Chicago, has been elected a Director of the Chicago & Alton.

D. M. Cameron has been appointed Auditor of the Southern Indiana, succeeding A. F. Williams, resigned.

Charles F. Gill, Chairman of the Official Classification Committee, has resigned on account of ill health.

Robert Meighen has been elected a Director of the Canadian Pacific, succeeding the late Sir Robert G. Reid.

Wilbur C. Fisk, of Harvey Fisk & Sons, New York, has been elected a Director and Vice-President of the Hudson & Manhattan.

Frank A. Walsh has been appointed Auditor of the Ashland & Western, with office at Ashland, Ohio, succeeding John T. Walsh, resigned.

R. L. Porter, Auditor and Assistant Secretary of the Wabash-Pittsburgh Terminal, has been appointed also Auditor of the Wheeling & Lake Erie.

I. E. Williams has been appointed to the new office of Assistant Auditor of the International & Great Northern, with headquarters at Palestine, Texas.

B. R. Petriken, Auditor of the Little Kanawha and the Bellington & Northern, has been appointed also Acting Auditor of the Marietta, Columbus & Cleveland.

B. A. Worthington, Vice-President and General Manager of the Wabash lines east of Toledo, Ohio, was appointed Receiver of the Wheeling & Lake Erie on June 8.

W. Oscar Hamilton, Treasurer of the Trinity & Brazos Valley, has been appointed Secretary and Treasurer of the Ft. Worth & Denver City, with office at Fort Worth, Tex., succeeding William Streator.

E. D. Edgerton has been appointed Assistant Auditor of the Newton & North Western and the Fort Dodge, Des Moines & Southern, a new office, in charge of daily and monthly statements, with office at Boone, Iowa.

The lease under which the Chaddo & Choctaw has been operated by the Prescott & North-Western has been canceled and it is now operated as an independent property with the following officers: T. W. Roxbrough, President; M. R. Smith, Vice-President and General Manager; DeWitt Davis, Secretary and Treasurer, all with offices at Rosboro, Ark., and O. H. Helbig, Traffic Manager and Auditor, with office at Prescott, Ark.

H. E. Suckling, Assistant Treasurer of the Canadian Pacific, has been appointed Treasurer, succeeding W. S. Taylor, who is to retire on June 30. Mr. Suckling has been successively Secretary and Treasurer of the Credit Valley Railway and the Toronto, Grey & Bruce, both now part of the Canadian Pacific; local treasurer of the Canadian Pacific at Toronto, and, since 1886, Assistant Treasurer of the Canadian Pacific, with office at Montreal, Quebec.

W. S. Taylor, Treasurer of the Canadian Pacific, who is to retire on June 30, was born in 1839, at Dornoch, Sutherlandshire, Scotland, and graduated from the Royal Academy at Taine, Scotland. He began railroad work in 1868 as Secretary of the Toronto, Grey & Bruce then under construction and since taken over by the Canadian Pacific. From 1873 to 1884 he was Secretary and Treasurer of that road, and on January 1, 1884, was made Treasurer of the Canadian Pacific, which office he has held until the present time.

Operating Officers.

J. L. Soule, Auditor of the Missouri River & Northwestern, has been appointed Superintendent.

J. T. Noah has been appointed Trainmaster of the Monongahela Connecting, succeeding John Kerr, deceased.

The office of C. B. Fletcher, Superintendent of the Omaha and Cherokee divisions of the Illinois Central, has been moved from Cherokee, Iowa, to Fort Dodge.

The office of L. M. Souders, Assistant Superintendent of the Empire Line, has been moved from Cleveland, Ohio, to Chicago. His address is 234 Lake street, Chicago.

J. T. Hallisey, chief train despatcher of the Intercolonial at Truro, N. S., has been appointed Acting Superintendent of the Halifax and St. John district, succeeding G. M. Jarvis, deceased.

J. C. Ridell, Superintendent and Master Mechanic of the Little Kanawha and the Bellington & Northern, has been appointed also Acting Superintendent of the Marietta, Columbus & Cleveland.

John A. Zehner, Division Engineer of the Lehigh Valley, has been appointed General Superintendent of the Lehigh & New England, with office at Bethlehem, Pa., succeeding R. G. Kenly, resigned.

J. M. Davis, Acting General Superintendent of the Oregon Short Line and the Southern Pacific lines east of Sparks, has been appointed General Superintendent of these lines, with office at Salt Lake City, Utah.

H. L. Joyce, Manager of Lighterage of the Central of New Jersey, has been put in charge also of the operation and maintenance of the company's sea-going tugs and barges, succeeding H. T. Wintringham, resigned.

The office of H. B. Earling, General Superintendent of the Chicago, Milwaukee & St. Paul of South Dakota and the Chicago, Milwaukee & St. Paul of Montana, has been moved from Minneapolis, Minn., to Miles City, Mont.

Traffic Officers.

Andrew Simpson has been appointed General Agent of the American Refrigerator Transit Co. at Des Moines, Iowa.

L. M. Foss has been appointed General Agent of the Chicago Great Western at Butte, Mont., succeeding W. H. Comer.

E. A. Neil has been appointed to the new office of Traffic Manager of the Brookhaven & Pearl River, with headquarters at Buffalo, N. Y.

F. S. Warrington has been appointed General Agent of the Atchison, Topeka & Santa Fe at Sacramento, Cal., succeeding W. P. Hinchman.

F. E. Winburn has been appointed Freight Claim Agent of the Atlanta & West Point and of the Western of Alabama, with office in Atlanta, Ga.

H. M. Dressell, city passenger agent of the Wabash at Pittsburgh, Pa., has been appointed General Agent, Passenger Department, at Pittsburgh.

W. H. Upton, General Superintendent of the Paris & Great Northern, has been appointed also General Freight and Passenger Agent, succeeding Charles Griffith.

G. Roy Hall has been appointed Traffic Manager of the Duluth, Rainy Lake & Winnipeg, in charge of all freight and passenger traffic, with office at Duluth, Minn.

W. B. Wheeler, General Agent, Passenger Department, of the Lehigh Valley, at Buffalo, N. Y., has been appointed General Western Passenger Agent, with office at Buffalo.

G. B. Tyler, commercial agent of the Atlanta & West Point and the Western of Alabama at Cincinnati, Ohio, has been appointed Central Western Agent of these roads.

Robert F. Kelley, Assistant General Passenger Agent of the Wabash-Pittsburgh Terminal, has been appointed General Passenger Agent of this road and of the Wheeling & Lake Erie.

Fred G. Salter has been appointed European Traffic Manager of the Grand Trunk and of the Canadian Express Company, with temporary headquarters at 20 Water street, Liverpool, Eng.

P. M. Seymour, General Freight and Passenger Agent of the Little Kanawha and the Bellington & Northern, has been appointed also Acting General Freight and Passenger Agent of the Marietta, Columbus & Cleveland.

W. R. Lynch, traveling passenger agent of the Cleveland, Cincinnati, Chicago & St. Louis, at Cleveland, Ohio, has been

appointed General Agent, Passenger Department, at Cleveland, Ohio, of that road and of the Lake Shore & Michigan Southern.

Engineering and Rolling Stock Officers.

George A. Ricker has been appointed Consulting Engineer of the Canadian Pacific.

The office of F. T. Myers, Chief Engineer of the Mississippi Central, has been moved from Roxie, Miss., to Hattiesburg.

J. E. Libby has been appointed Master Car Builder of the Swift Refrigerator Transportation Company, succeeding O. M. Stimson, resigned.

S. D. Brady, Chief Engineer of the Little Kanawha and the Bellington & Northern, has been appointed also Acting Chief Engineer of the Marietta, Columbus & Cleveland.

Herman Denburger has been appointed Supervisor of Bridges and Buildings on the Lehigh & New England, with office at Bethlehem, Pa. He will have charge of all work in connection with the construction and maintenance of bridges and buildings.

Harold Knight, who was recently appointed Division Engineer of the Erie at Salamanca, N. Y., was born October 28, 1881, at Stockport, N. Y. He is a graduate of Sheffield Scientific School, Yale University, class of 1904. He began railroad work in August, 1904, as rodman on the Erie, at Elmira, N. Y. The next year he was made transitman, and in October, 1905, was promoted to Assistant Engineer, which position he held until his appointment on June 1 of the present year as Division Engineer.

A. G. Shaver, who was appointed Signal Engineer on the Chicago, Rock Island & Pacific, on June 1, is a graduate of the Rose Polytechnic Institute of Terre Haute, Ind., finishing his course as electrical engineer in 1897. For about one year he was employed in the motive power department of the Pennsylvania, and then went to the Chicago & Eastern Illinois as batteryman and electrician. In April, 1901, he was appointed Assistant Engineer of the Union Pacific, and in November of the same year was made Signal Engineer. In April, 1906, he was appointed Engineer of the Hall Signal Co., New York, and remained in that position until his present appointment. Mr. Shaver's headquarters will be in Chicago.

A. G. Shaver.

OBITUARY NOTICES.

A. J. Burt, Auditor of the Michigan Central, died in Detroit, Mich., on June 11. He was born in 1847, in Macomb county, Mich., and began railroad work in 1875 as general bookkeeper on the Michigan Central. In 1882 he was made chief clerk and in 1890 was promoted to Assistant Auditor. Two years later he was made Auditor, which position he held until his death.

G. M. Jarvis, District Superintendent of the Intercolonial at Truro, N. S., died suddenly at St. John, N. B., of heart disease, on May 3. He was born in 1851 in Pittsburgh, Pa., and was educated in the common schools at St. John. He began railroad work in 1868 as a telegraph operator on the Intercolonial. In 1871 he was made train despatcher at St. John and three years later was made freight and baggage clerk at Moncton, N. B. The next year he was made train despatcher at the same place. In January, 1877, he was promoted to chief train despatcher, and in 1898 was made Superintendent at Truro.

Railroad Construction.

New Incorporations, Surveys, Etc.

Baltimore & Washington (Electric).—Authority is said to have been granted to this company by congress to build a line into the District of Columbia. Alexander Brown, Henry W. Williams and N. Winslow Williams, of Baltimore, Md., are interested.

Beaumont & Great Northern.—This company has opened for traffic its extension from Onalaska, Tex., southeast to Livingston, 13 miles. It is now in operation from Trinity, on the International & Great Northern, to Livingston, 33 miles. (Aug. 3, p. 247.)

British Columbia (Electric).—It is said that Boyd & Craig, Vancouver, B. C., have been awarded the contract for building the first 12 miles of line between Westminster, B. C., and Chilliwoc. R. H. Sperling, Superintendent, Vancouver, B. C.

Brookings & Sioux Falls (Electric).—It is said that this road will build this year a line from Brookings, S. Dak., to Flandreau, 10 miles. Neill Stewart, of Brookings, is interested.

Cincinnati & Birmingham Air Line.—Location work, it is said, is to be started on the first section of the proposed line from Paintsville, Ky., in Magoffin county, southwest to Somerset, 120 miles. The line is projected south in all about 400 miles, through Tennessee to a connection with the Nashville & Huntsville, which is said to be building from Nashville, Tenn., south to Huntsville, Ala., 105 miles, and which has projected an additional 100 miles south to Birmingham. J. H. Connor, Nashville, is President. (See Nashville & Huntsville, May 8, p. 655.)

Cincinnati, Kentucky & Virginia.—This company, which was incorporated in North Dakota, has, it is said, filed incorporation papers in Kentucky to build a line from Cincinnati, Ohio, to Charleston, S. C., about 500 miles. Robert Wynn, Mount Sterling, is interested.

Duluth, Missabe & Northern.—This company is said to be planning to build a large storage yard just west of Hibbing, Minn. About 20 miles of track will be laid and coal docks and a roundhouse will be built. H. L. Dresser, Chief Engineer, Duluth.

Eagle Valley.—It is said that work on this road will be started about July 1. The road will be narrow-gage and will run from Baker City, Ore., northwest to the mining district, 70 miles in the interior, where it will tap the Eagle and Pine valleys and the copper country in the Cornucopia mountains. A. B. Jacobs, Cincinnati, Ohio, is said to be interested.

El Reno, Red River & Pacific.—See Fort Smith & Western.

Estacado & Gulf.—Incorporated in Texas with $100,000 capital, and headquarters at Roby, to build from Roby southeast through Fisher, Jones, Taylor, Callahan and Coleman counties, about 100 miles. William A. Bates, Ft. Worth, Tex.; F. H. Landon and J. T. Butte, Weatherford, Tex.; B. H. Johnston and C. H. Jewell are incorporators.

Fort Smith & Western.—The El Reno, Red River & Pacific was recently organized with $5,000,000 capital to build an extension of F. S. & W. from El Reno, Okla., southwest via Cordell and Bettina, thence via Wellington, Tex., to Memphis, 150 miles. H. C. Bradford is President of the new company. (May 8, p. 655.)

Fort Wayne & Springfield (Electric).—This company is said to be considering an extension from Decatur, Ind., through Spencerville, Mandone and Rockford, to Lima, Ohio, about 50 miles.

Gary & Southern Traction.—Said to have been organized with $10,000 capital to operate a traction line between Gary, Ind., and Crown Point. John Brown, Crown Point; Warren Bicknell, Cleveland, Ohio; O. H. W. Seaman, Clinton, Iowa; Frank M. Clark and Henry C. Wood, Chicago, are interested.

Gary-Hobert (Electric).—Organized, it is said, with $10,000 capital stock to operate a line in and between Gary, Ind.,

Liverpool, East Gary and Hobert. L. Clark Wood, T. M. Campbell, S. O. Muhlhauser, William Earl and C. A. Teller are Directors.

GIDEON & NORTH ISLAND.—Organized with $120,000 capital to build a line from Malden, Mo., through New Madrid county to a point in Pemiscott county, 12 miles. W. P. Anderson, M. S. Anderson, M. V. Mumma, of Gideon, and N. V. Turner, L. I. Yeagley, of Malden, are incorporators.

HOUSTON & BRAZOS VALLEY.—It is said that J. C. Tolman, Civil Engineer, has been awarded a contract to build an extension from Velasco, Tex., south to Gulf, about 3½ miles. Felix Jackson is Vice-President and General Manager.

HUDSON & MANHATTAN.—This company, which since February 25 has been operating its north tunnel from the Delaware, Lackawanna & Western station in Hoboken, N. J., to Morton street, New York, thence northeast to Nineteenth street and Sixth avenue, recently opened to traffic the next section north to Twenty-third street. (March 13, p. 391.)

INDIANAPOLIS, CLOVERDALE & TERRE HAUTE TRACTION.—This company, it is said, has taken out new articles of incorporation to operate a line in and between Indianapolis, Ind., West Newton, Mooresville, Gasburg, Monrovia, Clogerdale, Brazil, Terre Haute and other places en route. E. M. Bowman, H. F. Butze, S. P. Axtell, W. L. Cook, H. C. Samdresky are Directors.

INTERBOROUGH RAPID TRANSIT.—Announcement has been made by the New York Public Service Commission, First district, that the work of widening the present subway from Ninety-sixth street and Broadway north to One Hundred and fourth street is to be started within 30 days. The improvements are to be carried out by the Interborough Rapid Transit Co., and paid for out of an appropriation made by the city. It will take about 18 months to finish the work. (March 13, p. 391.)

JOPLIN & PITTSBURGH (ELECTRIC).—Contract is reported let to the Woods Bros. Construction Co., Springfield, Mo., for track laying, bonding and ballasting 25 miles of the line being built from Joplin, Mo., northwest to Pittsburgh, Kan. Contract for the overhead work has also been let. (May 22, p. 718.)

KANSAS CITY, OZARKS & SOUTHERN (ELECTRIC).—Plans are being completed for building this line from Mansfield, Mo., to Ava, the preliminary survey for which was made last December. The town of Ava has raised a bonus of $30,000 for the road and the building of the main offices and repair shops at that point. J. B. Quigley, Engineer, Sedalia, Mo.

KENTUCKY & OHIO RIVER (ELECTRIC).—Contracts for building part of the Kentucky & Ohio River Improvement Railroad, an interurban line from East Cairo, Ill., east to Paducah, Ky., 38 miles, have been let to Simms Bros., Thebes, Ill., for $70,113. For building the 18 bridges on the line, contracts were let to Forbush & Stotlar, Benton, Ill. The General Electric Co., Schenectady, N. Y., is to furnish the cars and equipment, their bid being $48,750. The total cost of construction will be about $716,159.

LOUISVILLE & ATLANTIC.—It is said that the four-mile branch from Heidelberg to Idamay, for handling coal, has been put in operation.

MEXICAN INTERNATIONAL.—Surveys, it is said, are being made at Torreon, Mex., for new yards there. The present yards in the heart of the city are to be abandoned and new ones put in at a point between the passenger station and the smelter. Other improvements are also to be made.

MISSISSIPPI CENTRAL.—The Natchez & Eastern has been opened for business from Brookhaven, Miss., west to Natchez, 67.9 miles.

MISSOURI & NORTH ARKANSAS.—An officer writes that nothing definite has been done towards the extension of a branch line from Negro Hill to Little Rock. Preliminary surveys and estimates have been authorized, and until these are completed no decisions will be reached. (May 22, p. 718.)

NASHVILLE & HUNTSVILLE.—See Cincinnati & Birmingham Air Line.

NEW ORLEANS, MOBILE & JACKSON.—This company, organized at Jackson, Miss., in January, 1908, to take over the Mobile, Jackson & Kansas City and the Gulf & Chicago, is to build from Ovett, Miss., on the Mobile, Jackson & Kansas City line, south through the counties of Jones, Perry, Pearl River and Hancock, about 85 miles in Mississippi, thence to New Orleans, La. The New Orleans, Mobile & Jackson is to take over the two existing roads in 30 days.

NEW ORLEANS PUBLIC BELT.—It is reported that this road will be in operation about August 1 from the Jefferson parish line to Montegut street, 26 miles, double track. The Orleans Engineering Co., 715 Macheca street, New Orleans, is the contractor. W. J. Hardee is Chief Engineer.

NIAGARA, ST. CATHARINES & TORONTO.—The Welland division of this road has been extended from Fonthill, Ont., south to Welland, 4½ miles.

NORFOLK & WESTERN.—On the Pocahontas division a new branch has been opened for business from Honaker, Va., to Blackford, 5.3 miles.

PARRAL & DURANGO.—Work is now under way by R. M. Dudly on the extension of this road from Mesa de Sandia, Durango, south about 12½ miles. It is expected to have the extension finished by September. (March 13, p. 396.)

PENNSYLVANIA.—A line from Ellsworth, Pa., on the Ellsworth branch, to Marianna, eight miles, has been finished and is now operated as a part of the Ellsworth branch, Monongahela division. That portion of the present Ellsworth branch from Ellsworth to the terminus at Cokeburg, 2½ miles, is now called the Cokeburg branch.

ST. JOSEPH & GRAND ISLAND.—This company has opened for business a branch from Stout, Kan., north to Highland, seven miles.

SABINE VALLEY.—Incorporated at Marshall, Tex., with $200,000 capital, to build from Marshall, Tex., south through Harrison, Panola, Shelby, San Augustine, Sabine, Newton, Jasper, Orange and Jefferson counties to Port Arthur, about 200 miles. John Auchinclose, President, West Orange, N. J.; L. E. Walker, Vice-President and General Manager, Marshall, Tex.; E. P. Taylor, Jr., Vice-President, New York; R. Y. Walker, Engineer in charge at Marshall.

SARATOGA & ENCAMPMENT.—Rails were recently shipped to this company to be used on the extension building from Walcott, Wyo., south to Encampment, 45 miles, to finish track laying to a crossing of the Encampment river. Work, it is said, will be rushed to finish the extension to Encampment. (May 22, p. 718.)

SOUTH DAKOTA CENTRAL.—This road has been extended from Hayti, S. Dak., north to Watertown, 18 miles.

SPOKANE & INLAND (ELECTRIC).—Rails have been laid on the Moscow extension south to Viola, Wash., 10 miles south of Palouse. It is expected that the line will be completed to Moscow, Idaho, about July 1. (July 12, p. 54.)

UNION PACIFIC.—The St. Vrains branch on the Colorado division has been opened for business from St. Vrains Junction, Colo., to Dacona, 3½ miles.

UNION TRACTION CO. (ELECTRIC).—Organized in West Virginia with a capital of $150,000 to build from a point near the boundary of Wetzel and Marshall counties to New Martinsville, Brooklyn, Paden City, Sistersville and St. Marys, W. Va. H. W. McCoy, G. E. Work, S. G. Masser and R. Broadwater, of Sistersville; S. D. Morgan and E. L. Robinson, of New Martinsville, are the incorporators.

WASHINGTON, FREDERICKSBURG & GETTYSBURG (ELECTRIC).—Contract reported let to J. E. McDonough & Co. to build an extension from Lewiston to connect with the Monocacy Valley Railroad at Catoctin Furnace, 3½ miles. This will give a through line from Frederick, Md., to Thurmont, 15 miles. D. Columbus Kemp, of Frederick, is President.

WENATCHEE VALLEY & NORTHERN.—This company, which is building from Leavenworth, Wash., to Wenatchee lake, is said to have five miles of steel laid. It is also said that between 30 and 40 cars of rails are being shipped.

WICHITA FALLS & NORTHWESTERN.—This company is building

with its own men an extension of the Wichita Falls & Southern, from Olney, Tex., south to Belknap, 14 miles. It is said that plans are under consideration to continue the extension south about 50 miles to a connection with the Texas & Pacific at Cisco, Tex. (March 13, p. 395.)

Yankton Southern.—An officer writes that surveys are made and that rights of way and land for terminals in various towns and at tidewater have been secured for its proposed line. The prospects of building are good, but it is undecided when contracts will be let for the work. The projected route is from Yankton, S. Dak., south to David City, Neb., and Fairbury to Washington, Kan., thence south via Abilene, Newton, Wichita and Wellington to Atoka, Okla., thence via Palestine, Tex., Groveton, Onalaska and Fostoria to Houston, 1,007 miles. There are to be bridges over the Missouri, Platt, Canadian and Red rivers. Fremont Hill, President, 422 Northern building, Wichita, Kan. (June 5, p. 47.)

Railroad Financial News.

Boston & Maine.—See New York, New Haven & Hartford.

British Yukon Railway.—A mortgage dated May 26, 1908, securing an issue of bonds not to exceed £96,000 ($480,000) at the rate of £6,000 ($30,000) per mile, has been filed.

Central of Georgia.—Fisk & Robinson, of New York, are offering $250,000 consolidated mortgage 5 per cent. bonds of the Central of Georgia, of 1895-1945, at 104½, yielding 4.75 per cent. These bonds are part of a total authorized issue of $18,500,000, of which there is outstanding $18,200,000.

Chicago & Alton.—The directors have declared a first dividend of 1 per cent. on the common stock. Of the $19,512,800 common stock outstanding, $14,420,000 is owned by the Toledo, St. Louis & Western, which will therefore receive $144,200 as its share of the dividend. The Toledo, St. Louis & Western issued in payment for the stock $5,047,000 of its Series B 2—4 per cent. collateral trust bonds on which the annual interest charge is $100,940 until 1912, and $201,880 thereafter.

Chicago Railways.—The National City Bank and N. W. Harris & Co., of New York, are offering $3,000,000 Chicago Railways first mortgage 5 per cent. bonds of 1907-1927. This is part of a total authorized issue of $8,000,000 first mortgage bonds.

Denver & Rio Grande.—The stockholders are asked to authorize, at a meeting to be held July 23, a new refunding mortgage to secure $150,000,000 bonds.

Erie.—Arrangements have been made for the purchase, at par, in cash, of the coupons due July 1, 1908, and January 1, 1909, together aggregating $3,160,480, on the $35,000,000 prior lien 4 per cent. bonds and $44,012.000 general lien 4 per cent. bonds. J. P. Morgan & Co. will buy the coupons of July 1, 1908, and the coupons so bought will be pledged as additional collateral security for the 6 per cent. $15,000,000 notes which were authorized in April and of which $5,000,000 were sold to J. P. Morgan & Co., and $5,500,000 to E. H. Harriman.

The $1,500,000 first mortgage 6 per cent. bonds issued by the Buffalo & Southwestern, and maturing July 1, 1908, are to be extended to July 1, 1918. The $1,000,000 second lien 5 per cent. bonds of the Buffalo & Southwestern division of the Erie, maturing July 1, 1908, are also to be extended to July 1, 1918. J. P. Morgan & Co. are prepared to buy for cash at par any of the bonds which holders may not wish to extend.

Hudson Companies.—This holding company for the Hudson & Manhattan is to issue $5,000,000 one-year 6 per cent. notes secured by $10,000,000 of the company's 4½ per cent. bonds.

International & Great Northern.—The authority of the receiver, J. T. Freeman, has been extended by the United States Circuit Court, and the receivership cases pending against the railroad company have been consolidated.

Lehigh & New England.—This company has sold to Brown Bros. & Co., of Philadelphia, $450,000 equipment trust 4½ per cent. certificates, Series "A," guaranteed by the Lehigh Coal & Navigation Co.

Louisville & Nashville.—Fisk & Robinson, and Redmond & Co., are offering the unsold portion of $1,000,000 Louisville & Nashville unified mortgage 4 per cent. bonds of 1890-1940, at 97½, yielding about 4.15 per cent. This is part of an authorized issue of $75,000,000, of which there is outstanding in the hands of the public $39,648,000. Of the balance of the bonds authorized $138,000 only can be issued for new construction and equipment, the rest being reserved to retire outstanding prior liens.

Manhattan Railway.—This company, whose elevated lines in Manhattan and the Bronx, New York City, are operated by the Interborough Rapid Transit, has sold to Redmond & Co., New York, $11,712,000 consolidated mortgage 4 per cent. bonds of 1890-1990, issued to retire $10,818,000 6 per cent. bonds of the Metropolitan Elevated, which mature July 1. With the retirement of these bonds, the consolidated mortgage bonds become a first lien on the entire property.

Missouri-Kansas Interurban.—On June 6 this property was put in the hands of J. A. Edison as Receiver. The company operates 20 miles of road from Kansas City, Mo., through or near Rosedale, South Park, Merriam and Lenexa, to Olathe. It enters Kansas City over tracks of the Metropolitan Street Railway. The road has been operated by gasolene motor cars, but it is now proposed to operate it as a trolley road.

New York Central & Hudson River.—J. P. Morgan & Co., the First National Bank and the National City Bank, New York, are offering at 91½, yielding about 4.55 per cent., $13,000,000 30-year, 4 per cent. debenture bonds of 1904-1934. This is part of an authorized issue of $50,000,000, of which $30,000,000 were sold in 1904.

New York, New Haven & Hartford.—The proposed bill to take away from this company its right to vote the Boston & Maine stock owned by it was defeated in the Massachusetts House of Representatives on June 11 by a vote of 51 to 37. On June 13, Attorney-General Malone, of Massachusetts, asked for an injunction restraining the New Haven from voting the stock.

Oneonta & Mohawk Valley (Electric).—J. Choate, Chief Engineer and General Manager, has been appointed Receiver. The company operates a trolley road from Oneonta, N. Y., to Mohawk, via Cooperstown and Richfield Springs, and two years ago was sold under foreclosure for $960,000.

Philadelphia & Reading.—The Brookside, Lebanon & Tremont branch passenger train traffic and all passenger service between Brookside, Pa., and Williams Valley Junction will be discontinued.

South Dakota Central.—This company, owning 103 miles of road from Sioux Falls, S. D., to Watertown, is said to have executed a trust deed securing $1,000,000 5 per cent. 20-year bonds.

Texas Central.—The usual annual dividend of 5 per cent. on the common stock is not to be paid this year. It is said that dividends are omitted because of three serious washouts and shortage of the cotton crop.

Vandalia.—Speyer & Co., New York, have bought $3,000,000 consolidated mortgage 4 per cent. Series B bonds, maturing November 1, 1957.

Western Maryland.—The Receiver has been authorized to issue $1,205,722 two-year 5 per cent. receiver's certificates dated June 1 to provide for maturing equipment notes.

West Penn Railways (Electric).—Robert Glendenning & Co. have bought $300,000 first mortgage 5 per cent. bonds due January, 1931, and are offering them at 97, yielding 5¼ per cent. The West Penn Railways own 144 miles of electric railways south and east of Pittsburgh, Pa., serving McKeesport, Pa., Duquesne, Greensburg, Uniontown, Fairchance, and other smaller towns.

Worcester Consolidated Street Railway.—This company on May 28 asked the Massachusetts State Board of Railroad Commissioners for authority to issue $3,182,000 bonds to pay the floating and funded debt of the company.